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Increasing eLearning Engagement through Mobile Learning Integration

PHD IN COMMUNICATION AND ELECTRONIC ENGINEERING
2017

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Increasing eLearning Engagement through Mobile Learning Integration

By

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A thesis submitted to Plymouth University
in fulfillment for the degree of

DOCTOR OF PHILOSOPHY

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Faculty of Science and Engineering

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Authors Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award.

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Abstract

Increasing eLearning Engagement through Mobile Learning Integration

Athanasios Triantafyllidis

eLearning applications have penetrated the world of education as most higher education organizations all over the world choose to deploy eLearning applications. A review of literature and surveys performed confirmed that currently there is very little engagement of students in web-based eLearning applications, especially related to web-based constructive activities. In fact, eLearning platforms are mostly used as on-line repositories for a variety of course related documents without actively contributing to the learning process utilizing available modern learning methods. eLearning aims to actively engage students by making available learning content, but also through using interactive practices in the process of learning. Therefore, students in addition to access learning content may actively participate in the discovery of knowledge rather than being passive receptors to that content. Consequently, engagement of students to eLearning activities and content is important.

Two surveys were undertaken in order to identify the reasons why web-based eLearning platforms fail to achieve both constructivist learning and the required engagement by both students and instructors. In addition to that, these surveys investigated and measured the level of interactivity of both students and instructors with on-line Information Technology (IT) services offered by both web-based and mobile applications and services. The rationale was to investigate opportunities in creating a technology that can disseminate eLearning content that is mainly offered by institutional eLearning platforms and popular on-line services like social networks and communications services, in order to increase awareness, availability, and simplicity of eLearning activities and thus engagement to eLearning. The findings illustrated that most instructors fail to create and promptly support constructive eLearning activities largely because of the complexity and time required for such undertakings. Consequently, the critical student participant mass is not achieved. Additionally, it seems that most learning platforms rely on email messages and native applications' notifications to update both students and instructors on new interactions. However, these channels of communication are not within the preferred communication channels and thus updates become outdated and fail to serve their purpose. Finally, web-based learning platforms seem to be oriented around laptop/desktop computer use (i.e. a full sized computer screen) rather than adopting and adapting to current mobile use of technology.

The research presents a novel conceptual model of a mobile application that integrates and combines various already existing popular, on-line, web-based and mobile application services (communication, social media, voice command systems, etc.) including relative technologies (smart devices, mobile sensors, application servers), with institutional eLearning platforms. The aim is to increase the engagement of both students and instructors to eLearning, through constructive eLearning activities using a variety of existing popular technologies.

This research shows that a Mobile Technology Enhanced Learning (mTEL) technology that integrates eLearning activities to both students and instructors will assist in increasing the awareness of learners to eLearning activities. At the same time, it offers the means to access, respond and participate in learning activities virtually from everywhere, thus making interaction ubiquitous, simpler and prompt, thus addressing key eLearning weaknesses leading to low engagement. These benefits are offered to both students and instructors, for a variety of eLearning activities and tools (positivistic and constructive). The research goes one step further by evaluating mTEL's effectiveness.

A conceptual novel model of a mobile application was designed and positively evaluated to contribute in the resolution of the major problem of low engagement of both students and instructors to eLearning. This is achieved by technologically enhancing mobile learning and introducing learning activities and materials at the current, highly populated on-line ecosystems where learners are already engaged instead of expecting them to directly interact with the institutional web-based platforms.

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1. Introduction

More and more higher education organizations all over the world choose to deploy web based eLearning applications (Van Der Rhee and Rhee, 2007). The wide availability of Internet coverage, the large adoption of web services and the cost effectiveness of Information Technology, which provide the core foundations to build eLearning content and activities (Ruth, 2006) are among the primary reasons. eLearning applications, that combine the advantages offered by modern information technologies, have made an impressive entry in the field of education. In fact, that is actually shaping the long-term strategy of higher education institutions (Ruth, 2006).

However, it is frequently found that the deployment of such applications does not meet the long term expectations of higher education organizations (Singh, Worton and O'Donoghue, 2005). Taking into consideration that the goal and product of education is learning, the literature review covered in this research, exposes that there is a failure to meet the learning outcomes by overestimating the basic features of such applications. Educators underestimate the preparation required not only on the technical level but also on the perception of what learning is and how it is best achieved. The objective is effectively implement and develop sustainable learning environments that are active but also successful in their goal to provide actual empirical knowledge to students. In addition to that, other reasons that result in eLearning failure, lie in the areas of market research, financial planning, identity and definition (Mayes *et al.*, 2009). So eLearning, in order to be successful and in alignment with educational and institutional goals, is expected to succeed in a variety of contexts such as organizational, technological, pedagogical, learner, financial and sustainability (Mayes *et al.*,

2009). All these contexts pose a great challenge. That means that the benefits received from eLearning should compensate for its investment cost following the institutional strategy. For this to be achieved the appropriate technology needs to be made available to people that do have the pedagogical and technological knowledge to use it. In addition, despite the increased awareness of instructors on the value of Technological Enhanced Learning (TEL), only a small number of instructors are technologically and pedagogically prepared to use and adopt eLearning technologies mainly because of the above challenges (Dias and Diniz, 2012).

According to Sims (2000) Learning is manifested through four dimensions: “Learners - the who of the learning process, Content - the what of the learning process, Pedagogy - the how of the learning process, and Context - the when and where of the learning process”. It seems that Learning Management Systems (LMSs) fully cover the content dimension. At the same time, the context of learning has also been impressively - yet not fully - supported by eLearning systems being able to deliver content anywhere through the web. However, (as investigated in [chapter 4](#)) effort in reducing the gap between learners, content and largely context, seems to be only partially achieved due to the small engagement¹ of eLearning users. This leaves a lot of distance to be covered as indicated by the research presented in [chapter 4](#). The pedagogy dimension seems to be the only one not fitting in the eLearning environment by default. By researching pedagogy to understand how to best align it with information technology, numerous and variant approaches to learning were found (Sims,

¹ Engagement: For the purpose of this thesis, with the term engagement, a user of an eLearning activity who actively interacts and responds to the requirements of this activity throughout its whole duration is described. An engaged user could either be an instructor or a student.

2000). The most important among them is interactivity, which according to Jonassen (1988), is best supported by computer based instruction with the possible intervention of a human tutor. Evans in his research concludes, that test scores have been positively affected, when adding interactivity to computer based delivery of learning content, as it adds the benefit of increasing the depth of learning and understanding to the concepts delivered (2007). So, it seems that the information technology environment is suitable for learning, provided that it is aligned appropriately with the pedagogical methods which are necessary to provide the service in a way that it achieves its goals. This led to the conclusion that the low engagement of learners is not because technological limitations fail to meet the requirements of learning models, theories and activities. In fact, despite the low engagement, their contribution to education is positive but not productive. Although they seem to properly serve a wide range of learning methods' specifications, users are still not attracted to satisfactory numbers. Thus, the solution of the low engagement problem is probably not found in technological enhancements on current eLearning software.

The research shows that the members of the learning community, students and instructors, are largely engaged and therefore familiar with social media and modern communication applications, through their adaptation in their daily habits (Mazer, Murphy and Simonds, 2007; Cheon *et al.*, 2012; Tess, 2013). Based on this evidence, an idea was formulated on the following assumption. Since, not only students but also instructors, spend a significant amount of their daily time on such services, those services may also be used for learning. That could happen in collaboration with institutional web-based learning technologies that currently are by far not included in the on-line daily habits of learners. The core

idea is that instead of trying to bring learners to eLearning, use technology to get eLearning to where the learners already are. The recommended way to achieve taking advantage learning but also non-learning services and technologies this will be thoroughly presented in **chapter 6**. A similar but rather limited idea was formulated in 2008 by Huang's paper on interactive mobile synchronous learning but it seems to have never been materialized (Huang *et al.*, 2008). A model called "Interactive Service Module" was suggested to establish interactivity between students and instructors using the Short Messaging System (SMS) service of mobile telephony without any integration to any eLearning platform.

A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was made to investigate the feasibility of the development of a sustainable Mobile Technology Enhanced Learning (mTEL) application. This application would keep the members of the learning community aware of and responsive to eLearning activities. That will be achieved through diverse use of technologies within the preferred on-line environment, where users already spend their daily time (like Social Media).

Based on the findings of the analysis, the Mobile Technology Enhanced Learning (mTEL) conceptual model was designed for a mobile application. mTEL undertakes the task to interconnect institutional web-based platforms to social networks and other commonly used communication services. It would also utilize currently available information technologies (sensors, smart devices, etc.) towards disseminating eLearning activity updates. Additionally, it will provide with the ability to actively respond to notification updates through a user friendly, simple and easy to navigate and interact interface within the users' environment. These updates will be made available and without geographic restrictions

provided there is Internet availability. For example, users may be updated on a certain eLearning activity, through their car's Bluetooth connection to a smart device, via a notification from the Facebook mobile application to which they may respond using the voice command system while driving. Consequently, users will not have to directly access the institutional eLearning platform to interact with those updates. They will not be required to use a pc or laptop or be at the campus as long as there are suitable devices on the premises (i.e. smart TV) that be used instead.

In order to present the mTEL conceptual model, a prototype was developed for Android mobile devices. The prototype can simulate the actual application's user interface in order to present the model not only to its potential users (students and instructors), but also eLearning experts. Because of that, it was possible to evaluate the proposed novel technology and its contribution to the evolution of learning.

An evaluation survey was deployed and discussion sessions were organized with eLearning experts. These experts provided positive evaluations and comments with respect to mTEL's contribution to learning, specifically in the field of eLearning by drastically reducing the low-engagement problem through a variety of innovative uses of information technologies and services available.

1.1 Research Aim and Objectives

The aim of the study is:

- Investigate the issues affecting the establishment of effective eLearning productivity and contribution to learning.
- Propose a novel prototype that can be used as a model to design a mobile technology that will contribute in the engagement increase of both

students and instructors to eLearning platforms by utilizing a variety of information technologies and services.

Towards achieving this aim, the following objectives are addressed:

- I. Understand learning by investigating pedagogical methods and historical sources throughout the entire evolution of learning.
- II. Recognize and investigate the main eLearning technologies implemented by Higher Education institutions.
- III. Through thorough literature review and by deploying surveys, understand the challenges affecting effective implementation of eLearning technologies.
- IV. Identify limitations of currently implemented eLearning technologies.
- V. Identify the opportunities available by other information technologies and services aside from eLearning.
- VI. Propose, define and develop a novel mobile information technology in effort to increase engagement of both students and instructors to institutionally implemented eLearning platforms.
- VII. Evaluate the proposed technology presenting a prototype model and assessing its effectiveness.

1.2 Thesis Structure

This research is comprised of seven chapters. In chapter 2, an overview of learning is presented, comprising of an analysis of literature on learning and pedagogical methods. The aim is to understand learning and the evolution of learning tools along with approaches in teaching touching upon the very beginning of learning up to modern eLearning platforms. Finally, a brief presentation of the major and most commonly used web platforms, Blackboard

and Moodle, is made with respect to their position in the Technology Enhanced Learning (TEL) market. This chapter summarizes the investigation made in order to understand the requirements of learning and examine not only the impact of using modern eLearning tools but also their deficiencies and challenges towards the aim to actively produce learning activities rather just being used as course document repositories.

Chapter 3 focuses on web-based eLearning penetration in Higher Academic institutions, understanding the attitudes and the expectations towards and from eLearning applications not only from a purely academic point of view but also from a Higher Education administration point of view. eLearning implementations need to satisfy not only educational goals but also should be in alignment with the administrative strategy of the educational institution. Additionally, technological trends and newly introduced technologies were also researched and referenced concluding with mobile learning. Mobile learning, although it currently represents the top trending technological ecosystem at large, is proven to be very poor with respect to eLearning implementations. Finally, the chapter closes by presenting a list of the major components offered by both Blackboard, and Moodle aiming not only to understand the contributions of current popular eLearning technologies but also their limitations by actively participating in the process and production of active learning actively using these platforms.

To understand not only the actual impact and limitations of current popular institutional eLearning platforms but also identify opportunities where technology may actively assist students in the actual process of learning, a survey was deployed to student participants. The outcomes and conclusions derived from the analysis of the survey data, are described in chapter 4.

Following the same logic and based on the outcomes of the student survey, a second survey was found necessary to be deployed in order to examine the views and the use of eLearning technologies by instructors of Higher Education institutions. This survey's outcomes and conclusions are also described in chapter 4.

Based on the outcomes of the surveys and the background literature review, chapter 5 conducts a thorough system analysis and design of a novel mobile Technology Enhanced Learning (TEL) application. Its aim is to contribute to learning through innovative mobile technology that will drastically reduce the low engagement problem of web-based eLearning platforms by both students and instructors. This is achieved by utilizing not only current eLearning platforms but also non-eLearning popular information technologies and services.

Presentations of the designed mobile application model were created and presented to students, instructors and experts. An evaluation survey for students and instructors and evaluation qualitative discussions with experts. The analysis of data and the derived conclusions are discussed in chapter 6.

Finally, the last chapter, presents the main conclusions and major achievements derived by the research followed by limitations and recommendations for potential improvements and further research. Appendices are also made available at the end of the thesis supporting discussions of the research chapters.

1.3 Research Methodology Adopted

In this section, the strategies and methods chosen for gathering and examining information are introduced and justified. Their selection depended on their capacity to provide the necessary answers to the research questions. The target groups were comprised of users of eLearning and their availability was mainly

related to students and instructors of a higher education institution in Greece (Deree College). Throughout this thesis, the intention of the researcher was to look for answers that would satisfy the questions arising during the research process. This was done by utilizing dependably deductively affirmed techniques in gathering and preparing the available information available within the limitations of the research environment. This approach is explained at Appendix VIII.

In this section, the general methodological logic applied throughout the thesis is described based on the literature review that was conducted for that purpose².

Overall, the methodological approach followed in this thesis is based on the inductive constructionism methodological approach while deductive approaches are used to further examine specific stages of the research. Within the context of an inductively evolving research a combination of both quantitative and qualitative methods were implemented where appropriate (see Appendix VIII).

The initial goal of the research is to find a novel way to improve the process of delivering learning to students using technology (please refer to Figure 1: Research Flow Chart). That could possibly be a way to drastically enhance current technology or introduce a new learning technology. Towards this end, it was found necessary to review pedagogy in order to understand how the various learning theories are manifested in current eLearning technologies. Additionally, a literature review was conducted in order to understand the environment within

² A summarized version of key methodological approaches selected from literature review is available at Appendix VIII. All approaches referenced in section 1.3, are explored in further detail at Appendix VIII. For the sake of the flow of the thesis, in section 1.3, the focus is only upon methodologies utilized in practice during the thesis. Other methodologies identified in literature review but not used here may also be found in Appendix VIII. Rational on why those approaches were not used by the thesis may also be found there.

which, eLearning technologies are deployed. Literature indicates that further to pedagogical and technological strategy factors, also administrative factors may have an essential impact in the implementation of eLearning strategies thus shaping the environment of the research. In fact, they offer a post-positivism view of the impact of the various factors that influence the formulation of eLearning strategies.

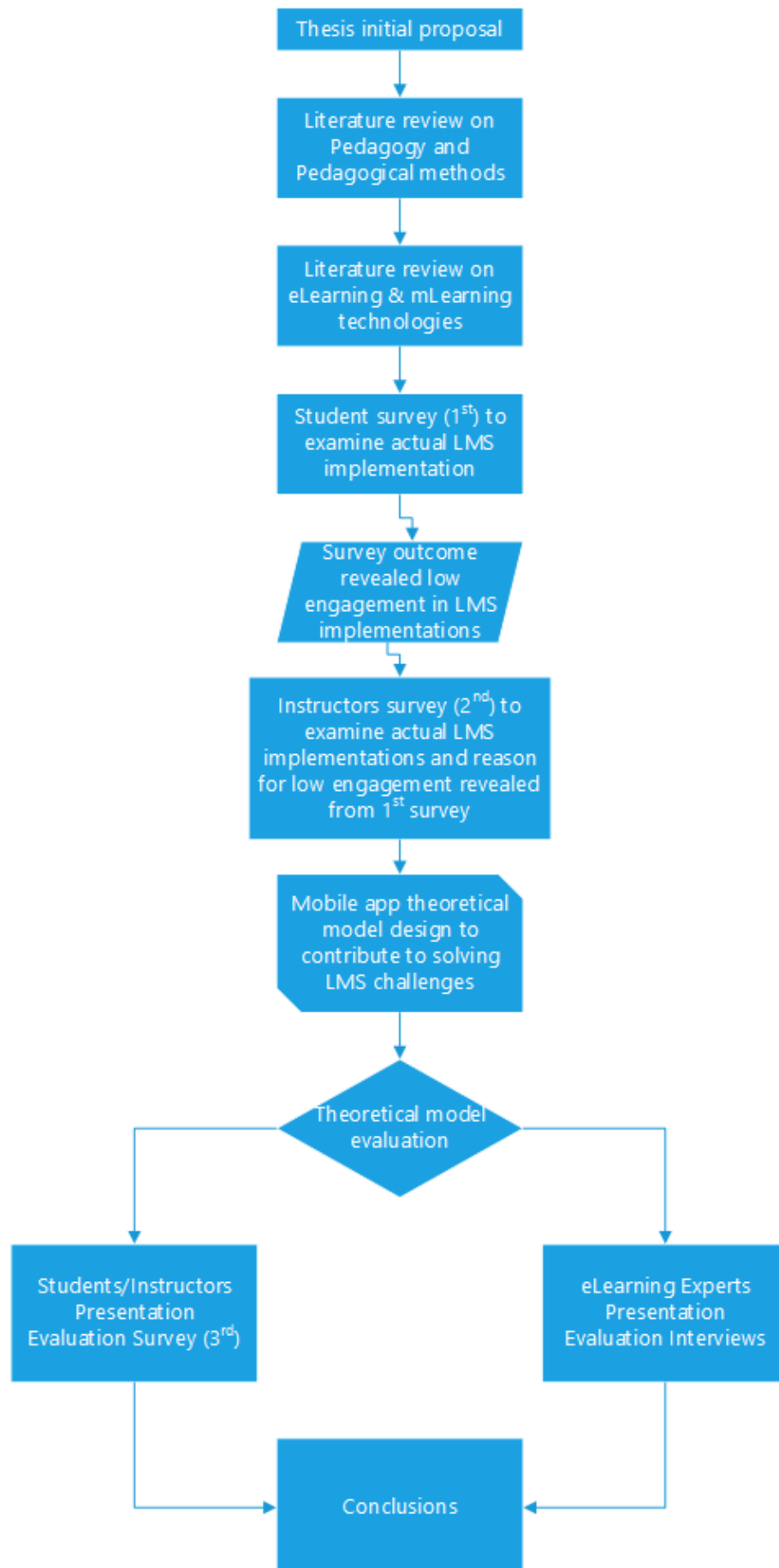


Figure 1: Research Flow Chart

At that point it was found appropriate, mostly by using deductive approaches, to examine implementations of Learning Management Systems (LMSs) as a major representative of learning technologies. Towards that purpose, a survey adopting positivism (web based questionnaires) was deployed to students in an attempt to provide indicative results towards the integration and adoption of eLearning in Higher Education Institutions. Simple descriptive statistics were found appropriate for providing indicative results on the general attitude of students not only towards LMS but also to confirm active LMS implementations. The results indicated deviations from the achievement of LMS goals. The outcome of this first survey leads to inductively examine and verify the weaknesses (as indicated by the student survey results) in a complementary, second survey with respect to eLearning implementations, targeting instructors. At this point, a questionnaire was structured, taking into consideration the outcomes of the first survey. The aim was to receive a more specific description of the challenges of LMS implementations towards achieving their goals.

The combined knowledge derived from the literature review and the survey outcomes lead to a deductive conclusion. There was no evidence indicating that the engagement challenges were related to weaknesses of eLearning software. There are challenges in the implementation of such software originating from lack of time, expertise and budget limitations. However, such challenges may be resolved by training, hired experts and generally more budget for new software development. So, the idea for further development of institutional LMS was abandoned and the focus was placed to identify characteristics of highly engaged market applications that could be adopted or used by eLearning. At this point, the idea to directly involve and use such market applications for learning was born.

As it will be presented in the following chapters, this idea was additionally supported by literature review that indicated that there were several experiments using social networks for education with very positive outcomes. Thus, the next inductive step was to develop a mobile technology theoretical prototype that could potentially contribute to the process of achieving the learning goals increasing the productivity of existing institutional LMSs. A conceptual prototype design was formulated within the context of the eLearning ecosystem, taking into consideration the factors found to have a major impact, namely pedagogic, technological and administrative. The conceptual design suggests that eLearning engagement may be achieved by an application that increases eLearning activity awareness and user participation and offers ubiquitous instant interactive access to eLearning content and activities (learning/pedagogical). This is not an application for learning but an application that facilitates learning providing a more fertile technological ground in an effort to increase users' participation and consequently engagement with current eLearning implementations. This is achieved through an easy to develop and simple to use, mobile application that mostly relies on existing technologies (technological) and has minimal development cost and maintenance requirements (administrative).

At this point, based on deductive epistemological logic, it was necessary to validate that the logic on which the prototype model was designed. The aim was to seek acceptance by the participants of the eLearning environment, whether the evaluated model could offer the suggested benefits in case an application like this was developed and made available to the learning ecosystem. Towards that aim, a non-working prototype application was created in order to demonstrate the User Interface (UI) described by the theoretical model. Since there was no

finalized application, the non-working prototype provided images of the UI that were used to create two presentations of the final product. Screenshots were presented in an effort *not* to evaluate the usability of the model but to provide a visual way that would be easier for the survey participants to understand the services provided and its logic. One presentation was created for students and instructors and another, more technical one, was presented to eLearning experts. Both presentations included a demonstration of the prototype functionality. Questionnaire based surveys were made available to students and instructors in order to evaluate the recommended application model. In addition, interviews were conducted with eLearning experts assuming a nominalist ontological approach. The objective was to get a strong indication of which are the learning community assumptions concerning the value of the recommended model and its contribution to learning.

The methodological details followed in all mentioned research methods in this section, such as questionnaire approvals, types of questions, methods of analysis, presentation, interview summaries, etc., will be presented at the corresponding chapters of the thesis and relevant appendices.

2. An Overview of Learning

Understanding learning from a pedagogy perspective is required to identify objectives that eLearning technologies are expected to contribute or achieve. That knowledge will assist in recognizing the opportunities but also limitations technology may offer to learning. Examining learning methods within their societal context and requirements of their deployed environment will help to decode the details that shape the learning outcomes expected to be achieved by students.

In this section of the thesis, the investigated areas were addressed within the context of the administrative environment in which eLearning implementations are made available. As it will be exhibited, educational administration plays an important role in the shaping of the institutional strategy and thus cannot be neglected from being examined.

Additionally, the major pedagogical models and methods are explored in order to reveal gaps in the implementation of such methods. The identification of such gaps led to improvement opportunities which were considered towards the designing of a new technology that may serve to reduce such challenges.

2.1 Learning and the Learning Ecosystem

Säljö (1979) interviews teenagers and adults with varying levels of formal education to define the concept of learning:

“The concept was variously defined as: (1) an increase in knowledge (merely a synonym for the word learning); (2) memorizing; (3) an acquisition of facts or principles, which can be retained and used in practice; (4) an abstraction of meaning; and (5) an interpretive process aimed at understanding reality”.

Bringing the subject of learning to educators at Institutions of Higher Education, teaching is agreed to be the process for equipping students with the knowledge instruments that will permit them to survive within a niche of the modern

competitive market. Thus, learning is the reception of that knowledge. Today, because we live in the information age, expert knowledge in a field is a goal, both pursued by students and expected by the market.

Higher education institutions are expected to provide the experts. So, what determines the commerciality potential of TEL can be viewed from three different perspectives: The Government, Higher Education Institutions and the market. For businesses and the government, that are mostly cost centric organizations, traditional instructional learning may involve additional costs (e.g. travel expenses). In such cases, TEL seems to offer a suitable tool for training employees (David, 2006), since physical presence in many cases is not required. Research findings like Sissine's article (2014) report cost reductions up to 42% from classroom costs alone. Additionally, it cannot be ignored that "Colleges with a higher share of online students charge lower tuition prices" due to cost reduction achieved by the implementation of eLearning (Deming *et al.*, 2015).

As Lazowska (2008) rightfully observes, technology can be a powerful tool to be utilized by researchers, educators and students. The Internet and its use to access network stored knowledge available by researching online repositories and academic institutions, has reduced the time and costs required to access the knowledge available.

In the case of Deree College, the higher education institution used as a sample model in this research, a large percentage of courses are mainly delivered through lectures, based on an approved textbook and possible other available online or offline resources. However, in their report on "How People Learn: Brain, Mind, Experience, and School", the Committee on Developments in the Science of Learning of the National Research Council in United States clearly states, that

students in class will learn more of what is actually required by the market if their class environments are made very similar to the actual working environments (Bransford, 2000). Like an in-class working simulation. A relevant example of that could be the installation of an educational trading room to be used by students to simulate the trade of commodities similarly to real trading rooms. However, it should be considered that such implementations can be very expensive and are suitable for specific courses and limited students. Therefore, are not expected to be largely available by many institutions.

Traditional methods like lectures are extensively used because of the benefits they still offer to learning. However, it is logical to assume that traditional methods all by themselves, will not achieve the combined results offered by other possibly more effective methods. Nevertheless, the evolution in learning methods and models does not seem to be in direct relationship with the implementations introduced by the tools used to deliver learning. As a consequence, many of these innovations seem not to be widely used despite the improvements of technology and especially the technological innovations of the Internet, web 2.0 and mobile devices, all of which had a strong impact to educational tools (Lim, So and Tan, 2010). However, before getting into that, newer and alternative perceptions about learning methods should be examined. That is to establish a basis for the evaluation of eLearning tools and identify areas of improvement and weaknesses that resulted in the formulation of the recommended by the thesis technological model.

2.2 Learning Models and Theories

Positivism is a learning model that has dominated higher education for centuries. Based on positivism, absolute knowledge (“objective reality”) exists

independently of human perception (Prince and Felder, 2006). Ganly (2007) adds that positivism, also referred as logical positivism, is a teacher centered model that identifies as true knowledge only the outcome of provable facts. The teacher's job is to transmit this knowledge to the students and the students' job is to absorb it.

According to Sir Ken Robinson (2010), a world-renowned education and creativity expert who received the RSA's³ Benjamin Franklin award, in his speech titled "Changing Paradigms") chronically placed the origins of positivism at the end of the 17th century and afterwards, when the first organized schools and universities were established in Europe. He also implies that the system currently implemented in higher education is designed for the needs of the age of the Industrial Revolution. At that time, the learning requirements shaped by industrialism were more related to production, manufacturing and operation management. Thus, a subjective quantitative approach seemed more suitable. At the same time, job opportunities in the industry management, made people more motivated towards education as a step to have a chance for a career based better life.

Currently, effort is made to design the education of the future, relying on modern tools and revolutionary technology. However, it seems that this is mostly attempted with methods designed to service the needs of an age that has passed. In fact, the technological evolution has largely changed the educational needs of the current market compared to the needs of the Industrial Revolution Age. Nevertheless, what Sir Robinson states does not imply that positivism is obsolete. It rather suggests that modern education should not only rely on one model

³ RSA: Royal Society of Arts

despite its important contribution to modern learning. As it was presented in this section, the modern models of learning, by no means cancel the usefulness of positivism. For most of them, a certain positivistic method is required for knowledge to become available to learners. Newer models seem to act complementary to positivistic methods as additional ways to assist the creation of knowledge. Hence, the outcome of these arguments could be that the appropriate mix of methods for each specific group of learners is what is required to increase the effectiveness of modern education.

Consequently, according to the positivism model, the student in higher education, is expected to have reached a level of maturity and self-discipline, high enough so that they are self-motivated to absorb the knowledge. The teacher acts as an output device and the student acts as an input device. However, in reality, none of them are devices. As research will show, learning and student retention may be a more complex process that involves much more than just the “streaming” of knowledge through a typical lecture.

Constructivism, which is an alternative model, states that objective reality is irrelevant to the reality actually constructed and reconstructed actively by individuals, in an effort to make sense of their experiences (Prince and Felder, 2006). So, constructivism tells us that reality is not only what is told or what we read about a certain subject. It is structured continuously by learners including the experience of the process of learning and our active exposure to the subject. Knowledge is not just passively received from outside (Sjøberg, 2009). Mental structures (schemata) build up with students' prior knowledge, beliefs, preconceptions and misconceptions, prejudices and fears, are responsible for filtering new information (Prince and Felder, 2006). It may be integrated into them

if it is consistent with those structures. If not, it might assist in the form of memorization to pass an exam, but it is unlikely to be truly incorporated into their belief system and thus will not be learned. So, if the student is willing to absorb knowledge, education may find a method to additionally provide it in a way that it may survive the various barriers set by the life experiences of the student.

There are two types of constructivism. Radical and Social (Steffe and Gale, 1995). Based on literature research by Steffe and Gale (1995), radical constructivism refers to a truth/knowledge that is independent of the experiences of learners. Social constructivism refers to knowledge as being influenced and shaped by additional conditions set by the learners' experiences.

The literature review has revealed a plethora of learning theories that have been developed under the constructivist model of learning during the recent years. Although very interesting, constructivism seems to refer to more complex and less obvious implementations compared to positivism that may explain the volume and the variety of theories for this model such as behaviorism, inductive teaching, reflective teaching, etc.

Based on the methodological approach that was followed in this research, it was found necessary, that these variations and implementations along with their foundations in theories of learning from the perspective of psychology, were examined to provide the researcher with a more spherical and complete background on modern pedagogy. A short summary of this research may be found at Appendix X – Summary of reviewed Constructive Learning Theories and Models.

Furthermore, the research (Chapter 3) will identify evidence of change in technology that if implemented properly, might signify the beginning of a constructive learning era.

Following the inductive approach as described in section 1.3.1, reviewing learning models and theories was essential to this research since it provided a guide for the continuation of this theses towards examining both literature and available technologies. This step was found important to understand the value but also the weaknesses of the implementation of theory with technology in order to identify an area for the thesis to further contribute to eLearning.

2.3 Tools and Methods of learning

Throughout the years, technology has offered a variety of instruments that were used to enhance the process of learning but also assist in closing the gap of educational inability to apply the constructivism model. It is only fair to acknowledge the technological leaps that have occurred during the 20th and 21st centuries, from the notebook (paper based) to the netbook and from the chalkboard to eLearning applications. However, as Jonassen (Jonassen, 1992) states in his article "What are Cognitive Tools?", that only few tools have been originally designed for the purpose of being used in Education. Those include the notable chalkboard but also pencils, paper, calculators, etc. However, many tools built to service other purposes like projectors, transmitters and computers, were later on adopted to educational purposes but have not been originally developed to facilitate learning. Computers were also not built for educational purposes initially.

Moreover, in the past, according to Perkins (1986), instructional designers have been invested with these tools for the purpose of "designing" instruction which, in

effect, only constrained the learners. He argues that the design process of these tools does not benefit learners. Perkins concludes that the only ones receiving the benefits of the design process and use of such tools are designers themselves, but not learners.

From the survey conducted by the Joint Information Systems Committee (JISC) and Universities and Colleges Information Systems Association (UCISA) (2003), it seems that higher education is experimenting not only with several eLearning platforms including in-house developed tools but also with a quite large variety of tools not designed for education like ColdFusion, Dreamweaver, FrontPage, Macromedia MX, Microsoft Exchange, SQL and other Content Management Software.

Similarly to UCISA, the “eLearning Action Plan” of the European Commission broadly refers to eLearning as the use of the Internet and multimedia technologies for educational purposes (Debande, 2004) hence not specifically focusing on the design of eLearning models specifically for education.

Many surveys have stressed the strengths of LMS's with the most commonly reported usage as a course materials repository (positivism). According to Allen and Seaman (2010), 74% of the public Institutions in US, 51% private for-profit and 50% private non-profit support that online learning is a serious long-term factor of their institutional strategy. At the same time, colleges trying to reduce their costs while aiming to offer alternative options to their students, have started implementing this form of teaching (Young, 2011). An online materials' repository eliminates the cost of paper copies, while at the same time, provides access benefits to students.

With the exemption of the LMS tools like Blackboard and Moodle, all the available technologies of that time have been designed to support IT professionals' needs so they required specialized technical knowledge. Hence, educators were in a difficult if not impossible position to contribute in the development of Technology Enhanced Learning (TEL) applications. At the same time, LMSs were mostly supporting content management rather than learning. However, research in modern learning methodologies (Robinson, 2010), proves that providing a modern way for students to access course materials, is far from what students require to achieve the expected learning outcomes. Nonetheless, this observation does not by any means downgrade the value and the contribution of on-line repositories and the benefits they brought to distance learning (see section 2.4.2 Distance Learning).

So, one possible problem related to eLearning would be that many tools used by higher education were not tools designed for learning. Additionally, the ones designed for learning, took into consideration a mislead perspective to serve mostly designer needs and therefore they were often based upon incorrect specifications. Still, that is one way of viewing it. In this research, students and instructors are considered the two main components that participate in the learning process. Hence, one can argue, that tools that assist the instructor may also assist learners at least in an indirect way. For example, a logical assumption would be that better, faster and more efficient course management may free up time from instructor's already overweighed schedule. That can be used as quality time with students, for further research or for more personal quality time. Course Management Systems have managed to significantly offer improvement in the delivery of learning materials but in essence have not significantly contributed to

learning in any other way. So what Perkins (Perkins, 1986) observes in the way learning tools are built, does not suggest a weakness, but in fact a benefit with lots of room for improvement. Britain and Liber (2004) state that the key driver of every institution for LMS development is enhancing the quality of teaching and learning. However, in reality, it appears that institutions depend mostly in improving delivery of teaching materials and course announcements for enhancing the student experience. Pedagogical issues seem not to be among the prioritized factors to enhance the student experience yet.

However, progress has been made with the modern eLearning tools and the technological infrastructure of Web 2.0⁴. They have evolved into multipurpose platforms that can be used as a basis for building learning applications. According to Kommers & Jonassen (Kommers and Jonassen, 2001), cognitive tools are generalizable computer tools that are intended to engage and facilitate cognitive processing - hence cognitive tools.

Cognitive tools goal is to enable critical thinking and higher order learning which may include databases, spreadsheets, semantic networks, expert systems, multimedia and hypermedia construction, computer conferencing, collaborative knowledge construction environments, to a lesser degree computer programming and micro world learning environments (Jonassen, 1994). For that reason, they should be able to act as peers with learners.

So, eLearning tools, frequently built on modern technologies originally serving other purposes but also specifically designed for education, can now address the

⁴ Web 2.0 refers to the 2nd phase of the evolution of the World Wide Web whose main characteristic is the transition from static web pages to a dynamic web environment that focuses on user-generated content, user-collaboration and social media services (Definition of Web 2.0, 2017), (Web 2.0, 2015), (Turban, King and Lang, 2010).

larger audiences that do not have nor require technical expertise in order to actively use them and participate in the building of knowledge. Emerson and MacKay study (2010) indicates that online learning provides more interactivity that has an impact on student learning but also motivation. Additionally, interaction promotes active involvement of students in the learning process by placing them in a new cognitive environment which makes them more motivated and actively leading to higher academic achievements (Yablon and Yaacov, 2002). So, modern technology enhances positivistic implementations by making knowledge available and accessible by larger and distant audiences of learners. At the same time, the evolution of eLearning platforms provides opportunities for implementing constructivist approaches where possible. Thus, it may be concluded that the benefits of technology may provide equal enhancement opportunities for implementations following the positivism and the constructivism model where applicable.

Based on the Cambridge English Dictionary, interactivity is defined as “the involvement of users in the exchange of information with computers and the degree to which this happens” (Cambridge Dictionary, 2017). Hence, learners become participants in this interactive process and by that, experience a deeper level of cognition.

Findings exhibit, that Web 2.0 technologies and especially blogs used not only to post educational content but also for blog-based activities using comments, can be effective tools of education, improving the learning experience of students (Churchill, 2009; Bartlett-Bragg, 2003; Goldman, Cohen and Sheahan, 2008; Halic *et al.*, 2010). In other cases, web 2.0 tools such as Facebook and Twitter were used as sandboxes for simulating a real marketing environment, where

students were supposed to write a slogan for a fund-raiser, verifying theory into practice (Crews and Stitt-Gohdes, 2012). Experiments like that indicate that Web 2.0 on-line technologies and services, although not originally designed for education, may offer significant opportunities to education. In addition, Web 2.0 provided the foundation for applications like Blackboard and Moodle discussed in section 2.6 Current eLearning Platforms. Both those representative technologies offer of both positivism and constructivism tools that notably enhance their implementations.

2.4 Learning using Technology

Information technologies are being used extensively for assisting or facilitating learning. This section will examine some major cases of eLearning technologies methods will be examined in this section.

2.4.1 Blended Learning.

Blended Learning refers to the delivery of learning using mixed methods and tools, without necessarily including technologies although usually the inclusion of technology is preferred (Driscoll, 2002). According to Driscoll (2002), Variations of Blended Learning implementations may include combinations between the following:

- Different modes of web-based technologies such as streaming video and audio, virtual classrooms and text-based on-line resources. For example, attending a virtual classroom on the institutional eLearning technology and then visiting a blog to write a report about it.
- Different pedagogical approaches such as positivism and constructivism which although they may exist without technological assistance, the value added by modern technologies is mostly adopted. The approach here follows a present-practice-produce logic (Sharma, 2010). An example, it could be a lecture or a video to teach a concept, then lab training for hands-

on application of that concept and finally a project that students should do to demonstrate the knowledge received.

- Various instructional technologies including information technologies like videotapes, CD-ROMs, web-based eLearning platforms and films. An example could be students asked to watch a video and then assigned to complete exercises found on their textbook's accompanying CD-ROM. (Sharma, 2010)
- Actual job tasks with instructional technologies which facilitate learning by implementing the knowledge gained to actual working environments. EFG EUROBANK ERGASIAS one of the four major banks in Greece has established the Eurobank Academy eLearning system which is used by employees to access knowledge on their job-related tasks but also to assess them through on-line tests after completing training cycles. "The goals of the Academy are to ensure that quality standards are understood and pursued by personnel and to spread a high level of knowledge on Group products and services" (Eurobank, 2001).

Finally, according to the Department for Education and Skills (*Towards a unified e-learning strategy*, 2003) if learning is the outcome of the use of combined communication and information technologies then this should be considered eLearning.

2.4.2 Distance Learning

Distance learning refers to the delivery of education outside of the traditional classrooms which can be received without the physical presence of students in traditional campuses (Pandza and Masic, 2010). Occasionally, there are cases where physical presence is required in addition to distance learning delivery, such as the case of a student taking an exam on-campus. In such cases, according to Pandza (2010) the applicable term would be hybrid distance learning. Based on Amani (2014) eLearning is the most suitable tool to be used for distance learning. Additionally, it can be used to complement traditional face-to-face teaching in

which case, the applicable term would be Blended Learning. Distance learning should be considered as the field of education that specializes in the field of educational technology and instructional design that are used for the asynchronous and synchronous delivery of learning to students. Therefore, designing courses using combined eLearning and pedagogical methods is an inseparable part of distance learning. It should best be standardized at an institutional level to include concepts such as (1) defining distance learning for faculty, (2) requiring faculty to overview provided eLearning educational material, (3) organizing and delivering training workshops for instructors to learn how to develop on-line courses and (4) provide an institutionally standardized eLearning template to be followed in the development of courses using the institutional eLearning platform (i.e. Blackboard) (Griffiths, 2016).

However, distance learning has been criticized to overestimate the ability of students to manage their time often leading to students starting to learn close to the exam times. In the most frequent case of students taking multiple courses, that way of allocating time, often leads to course failure (Fojtik, 2015).

Based on Fojtik's research (Fojtik, 2015) it seems that, distance education very fast growth, is indirectly proportional to the improvement of the quality of teaching delivered that way. Nevertheless, the driver behind the fast growth of distance learning may be largely found on the fact that it is a cost-effective option for educational administrators, that despite its criticisms, obviously attracts a profitable number of students.

2.4.3 Handheld Learning

Handheld learning refers to the use of handheld devices by students for predefined tasks while the majority of such implementations have been carried

out within the context of empirical studies (Song, 2011). Such devices are used to facilitate handheld learning may vary between, Mobile Phones, PDAs, and clickers. Some even more innovative but mostly experimental devices like Qwizdom's full classroom package developed with SecEd which is a more sophisticated, specialized for education device version based on the one used of the *Who Wants to be a Millionaire?* TV series (Handheld learning, 2006; Zhu and Yang, 2009)

Obviously, the above examples of handheld devices are limited to mostly be used in classrooms adding value to specific traditionally delivered courses but also limited by the specific abilities of each device. For example, PDAs have been criticized for their unsuitable small screen and limited processing capabilities causing frequent freezes in the delivery of the learning content (Song, 2011).

Clickers, make traditional classes more interesting to students and additionally, provide immediate feedback, on students' perception of the delivered knowledge, to the instructor. However, they are mostly effective in specific classes where polls are a suitable tool for education. A clicker, also known as Instant Response System (IRS) (Chien, Chang and Chang, 2016) is basically a button based device providing usually four buttons which are pressed by the student to respond to instructor's questions. The devices may be personalized to each student and provide immediate feedback on the student responses as well as recording responses for further analysis. However, as Cien et al. (2016) observes, "so far there is no consistent and clear framework to explain why the use of clickers is effective or ineffective to facilitate academic learning outcomes". Additionally, technical limitations, inadequate learning resources, and high cost of physical equipment are challenges that need to be considered (Song, 2011).

Nevertheless, the fact that actions that are left without feedback are to be considered unproductive (Laurillard, 2002) feedback should be considered within the advantages of any technology that is capable of producing it.

Mobile phones are included in the devices that may be used for handheld learning. They are mostly used as clickers, by running a clicker application usually over a Wi-Fi network. One benefit additional to the clickers that may be observed here is that there is no device cost in this case since such applications are freely available in mobile markets such as Google Play.

Finally, Zhu and Yang (2009), expanded the definition of handheld learning to include Mobile Learning (mLearning). mLearning seems to be technologically evolving to a level that constitutes a separate eLearning technology by itself and thus it will be referenced in section 3.3 of this thesis document.

2.5 eLearning Modules or Activities

An eLearning Module or Activity refers to course materials – built on any of the generalizable platforms available on the market – that offers learners access to certain content with which the user may interact and experience learning. Not all modules made available by eLearning platforms are necessarily interactive or offer pedagogic activities, but a serious platform is expected to offer the possibility of such building blocks which are the essential to eLearning.

Here is an approach:

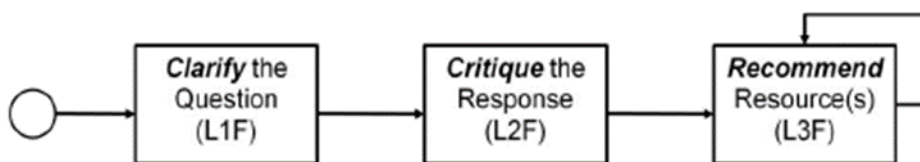
Formative Assessments

In the adaptation of STAR⁵ Legacy, based on Howard's study (2010), the assessment activity provides questions that require from learners to confirm their

⁵ Software Technology for Assessment and Reflection (STAR)

understanding of the materials presented during the cycle's Resources activity. A menu of categories related to the module's learning objectives with each question's text presented is offered to learners to select. Learners may use these questions at any time and as frequently they want.

Each question may be used several times and offers relative feedback each time as shown in Figure 2. When an incorrect attempt is made, the question is clarified by restatement (L1F). If a second incorrect attempt is followed, feedback with criticism on the learner's response is provided to the learner (L2F). The general rule for that feedback is: *"If X was true, as your answer indicates, then Yll,*



Source: (Howard and Johnson, 2010)

Figure 2: Feedback Progression in Module Self-Assessments

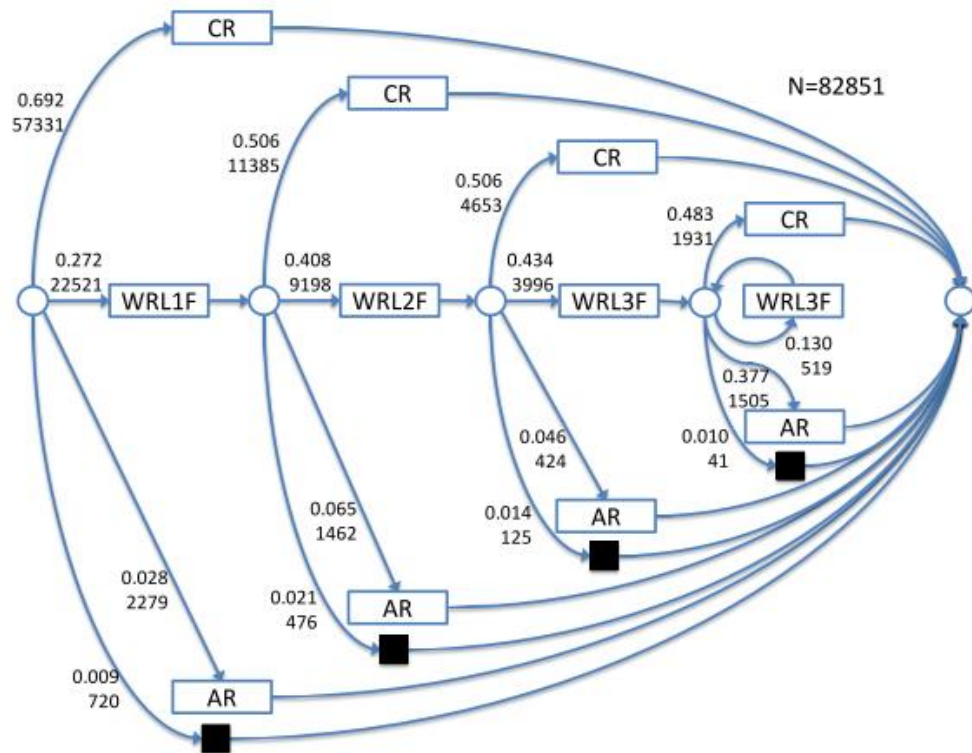
where *Y* is some negative consequence" (Howard and Johnson, 2010). If subsequent attempts are made, the critique feedback offers a link to the related learning materials provided in the Resources activity (L3F).

The model in Figure 2 assumes that an application could be possibly offered via the institutional eLearning platform. It introduces questions to the learner sequentially. Once instructions and a question is introduced (L1F) the application waits for the learner's response. The learner submits a response and the application determines if the response is correct or not. If the response is correct, then the learner may be informed and be introduced to the next question. If the response is incorrect (L2F), the learner is provided with some feedback, for example a hint, and is prompted to attempt submitting an answer again. In case the learner fails again, the application provides the learner with resources (for

example certain pages on a textbook, a video, etc.). At the same time, it stores the assessment process for the learner to continue from this point after having addressed the recommended resources.

The above model suggests that through multiple feedback options made available based on the choices of the student, the learner is offered with the opportunity to gradually discover knowledge while alternatively they would have quit the learning activity.

Surveying the above method, Howard (Howard and Johnson, 2010) provided the following evidence: From the whole of 82,851 question accesses that provided the mining results, 87% of these referred to first time access while a correct response was achieved in 93% of them. Almost 70% of the correct responses did not require feedback. A 13% of them have reached a successful answer through the proposed feedback process (Figure 3).



Source: (Howard and Johnson, 2010)

Figure 3: Petri Net Model of Accessing a Self-Assessment Question

Most popular eLearning platforms in the market offer the foundations to build such assessments. But before getting to the technology details let's acquaint ourselves with another learning method need to be examined.

This module seems to offer a technologically enhanced behaviorist approach to provide recursive stimuli to the learner by consistently guiding him towards addressing sources of subjective knowledge. However, by incorporating multiple diverse layers of knowledge sources it puts the learner through several positivistic contexts that if followed will gradually construct knowledge that additionally originates from the process followed and not just the content accessed. Thus, it may be argued, that this approach may serve as an example of a hybrid learning that blends a variety of learning build upon an eLearning implementation.

Cooperative Learning

One of the remarkable and fertile areas of education theory, research and practice, is cooperative learning. It happens when students work together in groups to achieve shared learning objectives. Student can achieve their own learning objectives only when the other members of the group achieve goals (Johnson, Johnson and Stanne, 2000).

Cooperative learning is another impressive method that is also supported by current eLearning platforms. Wikis, Chat Tools, blogs and Virtual Classrooms are technologically available today to provide assistance in cooperative learning (these tools will be further referenced within the context of specific eLearning platforms in chapter 3). However, it is worthy to be mentioned that such tools require some more substantial technological expertise and obviously good understanding of the pedagogical aims that are supposed to be achieved by the selected technology. Nevertheless, it seems that several of those technologies, like blogs, have captured the attention of educators, many of which, used blogging technology to provide and distribute educational content in an effort to enhance life-long learning (Cameron and Anderson, 2006). However, it seems that all these efforts were based on individual initiatives and were not part of an organized institutional effort. It has been observed that such initiatives led educational bloggers to improve their quality of their blogs over time indicating that such technologies may have a positive impact to cooperative learning, thus learning at large but it is evident that institutionally organized strategy should be applied before deriving to safe conclusions. Nevertheless, educational blog efforts seem to have been plenty enough to constitute their own category of

Educational Blogs or eLearning Blogs which refers to blogs focused in learning (Curran and Marshall, 2011).

Another approach to cooperative learning is through eLearning Communities (eLCs). eLearning communities use information technologies to offer an environment where groups of people may interact for the purpose of learning (Dascalu *et al.*, 2014). Such communities are supposed to stimulate interaction based on social presence which implies that learners participate among each other as being there. Technology is not required to be used for creating a virtual presence since it is more important that participants also perceive social presence through their satisfaction by the instructor and the course. Synchronous virtual classrooms seem to be one of the latest ways of implementing this approach where students are stimulated to interact with their instructor, peers, the interface and the available content and thus build knowledge through a constructive experience (Martin, Parker and Deale, 2012). However, it should be observed, that such technological innovations, which rely on social presence, can offer their benefits only if critical mass of participants is achieved. No evidence is found with respect to any technological innovation for the purpose of attracting participation and sustaining it.

The Flipped Classroom

The Flipped Classroom is an educational model where students are expected to have been prepared before class, frequently watching a short video, and the use class time for discussion, exercises and other activities based on what they show (Lacher and Lewis, 2015). Information technology is used for the access of such videos, often followed with on-line quizzes that offer feedback and the ability to go back to certain segments and rerun the video. Students being able to repeat

missing segments of the delivered knowledge and discuss it in class, are provided with the means and the time to reflect upon the delivered material and learn in class by applying the concepts taught. eLearning applications have come to assist the flipped classroom model by providing the technological background that is required to offer access to video lectures not necessarily individually but in groups. Such content can be supplemented by other eLearning constructive activities such as on-line quizzes or discussion boards that may enable collaboration towards initiating discussions relevant to the activities that are planned to follow in the classroom (Evseeva and Solozhenko, 2015). Again, the goal here is to make the classroom time more interactive and less boring by reversing the traditional positivistic method of delivering lectures to discussions, exercises and activities, while lectures are left to be delivered by technology. An example offered by Gilboy (Gilboy, Heinerichs and Pazzaglia, 2015) in Figure 4, shows a preparatory Flipped Classroom template describing to students the activities and steps that are expected to follow. Apparently, as Lacher argues (Lacher and Lewis, 2015), the effectiveness of the approach depends on that the students have made the required preparation or else class time is completely lost.

Week	Topic:		
1	Theories and Approaches for Behavior Change		
	Learning Objectives for topic: <ol style="list-style-type: none"> 1. Explain the importance of behavior change models and theories for a nutrition practitioner. 2. Describe major concepts of selected behavior change theories and models. 3. Describe major components of selected theoretical approaches to counseling. 4. Apply theory/approach to nutrition-related practical settings. 		
	Resources needed: poster paper, markers, 5 minute video clip description of jigsaw activity for students, completed theory table (from students)		
		Before Class	During Class
	Activities:	read, take notes, watch lecture and videos	jigsaw activity
	Assessments	Complete theory table (Low stakes worth 5 points of final grade) Dropbox on due date and bring a copy to class for in class activity	Instructor monitoring for understanding. <ul style="list-style-type: none"> • Mini-summary from each group • Clarify difficult concepts • Clear up misconceptions
	After Class Essay questions as part of mid-term exam		
	Suggestions for using the Template: <ul style="list-style-type: none"> • Make sure learning objectives use action verbs so you can assess the students. The objectives should align with the assessments. • Resources: this can be specific website, etc. • Activities can be: lecture screen-cast; web 2.0 tools; discussions, etc. • Assessments can be low stakes: such as a quiz, discussion board, focused discussion, and/or application of course content using web 2.0 tool (e.g., www.goanimate.com which applies material using a cartoon), etc. 		

Source: (Gilboy, Heinerichs and Pazzaglia, 2015)

Figure 4: Flipped Classroom planning template

Massive Open Online Courses or Courseware (MOOCs)

Massive Open Online Courses (MOOCs) have been recently introduced as a new method of delivery of education. It utilizes open access through the web making learning content available to users potentially everywhere where web access is possible (Dasarathy *et al.*, 2014). In addition to that, MOOCs permit socially active students to engage the community in a way where they may pose problems, provide answers to and even add additional material to the course content becoming contributors of knowledge for other students (Russell *et al.*, 2013). However, only a small number of MOOCs participants that start a course manage to complete it and earn a certificate (Kizilcec, Pérez-Sanagustín and Maldonado, 2016). Nevertheless, research has shown that many of the participants do not have an intention to cover a complete course but mostly some selected parts of it. Kizilcec (2015), in his survey findings, observes that approximately only half of the respondents in a MOOC started with an intention to earn a certificate.

MOOCs are a relatively new method of eLearning and not much research has been made yet available to fully understand their impact and potential future role on education. They are focused mostly to distance learning and they are not designed as a complementary tool to instructional learning.

2.6 Current eLearning Platforms

Among the most modern representative tools designed to serve as eLearning platforms are Blackboard and Moodle. They are the most popular, among the most frequently updated and among the most complete in terms of variety of content that can be managed or built but also is available to support. Also, they

represent two major sources of software development. The Commercial – Blackboard and the Open Source – Moodle.

2.6.1 Blackboard

Blackboard is the official LMS of Deree College which sponsors this research. Blackboard, with more than 20 million daily users, over 80 global client-led User Groups, over 200 partners, approximately 90,000 end users, leveraged by over 100 higher education institutions (*About Blackboard*, 2012), is clearly a leading commercial platform in education. Moreover, Blackboard site provides us with the following facts:

- *“More than 7 million people, 3,000 institutions in 170 countries using Bb Collaborate*
- *Over 17 billion student transactions each year*
- *Over 2.5 billion minutes of live collaboration occurring per year*
- *Approximately \$1.5 million saved in gas, travel and meal reimbursement saved for online learning provider IDEAL- New Mexico in one year*
- *Over 2 million mobile app downloads*
- *Over 3.2 million news articles read, 775,000 people looked up, 595,000 buildings searched, and 250,000 videos browsed” (About Blackboard, 2012)*

Blackboard, being commercial software provides support and guarantees quality of service. Among those services Managed Hosting and Student Services are included. Blackboard claims that *“they achieve the highest levels of hosting uptime, availability, and peace of mind—24/7 with more than 8.5 million active users, approximately 950 educational, corporate and government clients worldwide, guaranteed uptime rates of up to 99.9 percent managing over 4 petabytes (or 4,000 terabytes) of storage. As an example of student services, approximately 850 institutions and 15 million students served with over 3 million incidents handled annually through a multi-channel support provided 24 hours a day 7 days a week” (About Blackboard, 2012).*

Furthermore, Blackboard recognizes the benefits of collaborative constructivism, understanding that students today “*have different expectations, consumption patterns, and needs. Modern student expectations are higher, especially regarding technology. Blackboard claims that it can improve access to education, facilitate collaboration and engage students in a manner that they desire*” (Solutions, 2012).

Of course, it should not be expected that all the above admirable features are available once you have installed the application into your servers. What is available is the platform which provides foundations to build eLearning contents and activities, given that the version and the extensions that have been installed support the methods you need to implement. Hence, this does not resolve the problems of time and expertise required to develop such activities using Blackboard and cannot guaranty the engagement claimed by it.

Furthermore, Blackboard is a commercial application and it does not come cheap. Besides the one-off initial cost of acquiring the software and hardware required for your specifications, Blackboard commercial version adds a recurring cost to the yearly budget. Oladiran (Oladiran, 2009) recognizes that, there are challenges due to escalation of the license fee, the long term sustainability of the commercial LMS and also the implication of easy availability of free open courseware platforms. Most important such platform is Moodle.

2.6.2 Moodle

Moodle is the second eLearning Platform widely available. Blackboard was the leader software in terms of usage by the educational market when this research started on 2011, however, since 2008 it seems that there is a weakening in its position as Moodle, being the only strong open source competitor, got a larger

share throughout time (Browne *et al.*, 2010). Moodle is a similar to blackboard software and is fully capable of developing online courses and course web sites (*About Moodle - MoodleDocs*, 2012) .

Moodle LMS was created by Martin Dougiamas who had the idea to create “social constructionist framework” for learning based on Information Technologies while he was doing his Ph.D. (Oztekin, Kong and Uysal, 2010).

According to Moodle official site there are 76781 currently active sites that have registered from 231 countries as visualized in Figure 5 (*Moodle Course Management System Registered Sites*, 2016).

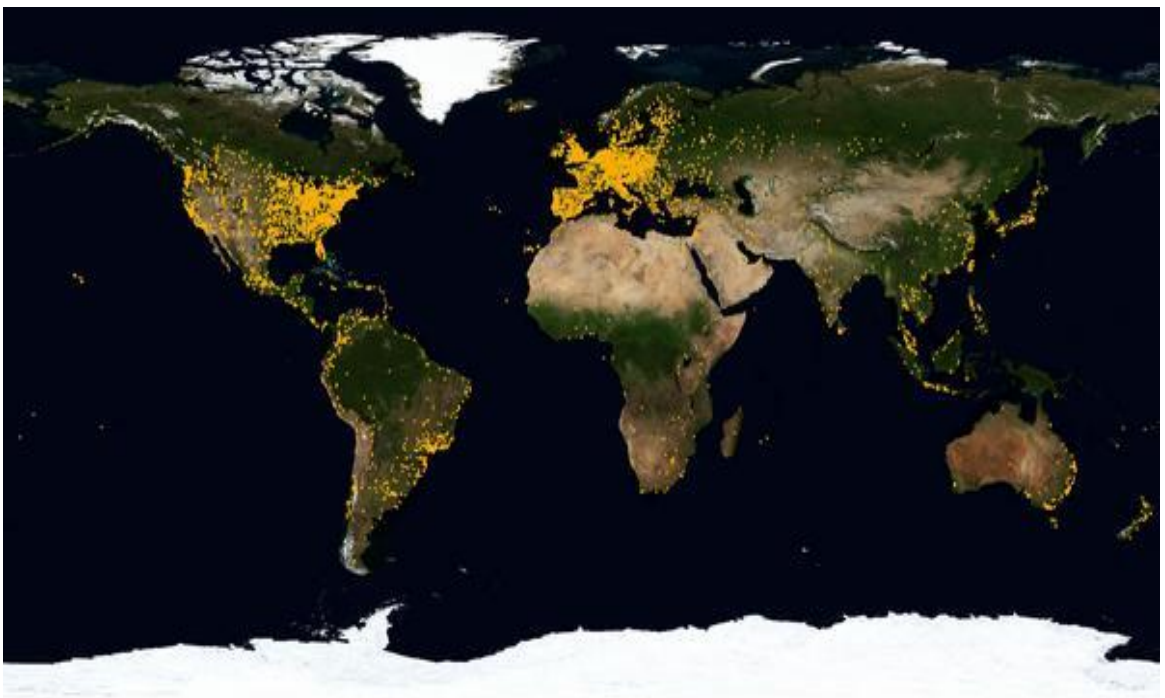


Figure 5: Registered Moodle sites (*Moodle Course Management System Registered Sites*, 2016)

As a term, Moodle stems from Modular Object-Oriented Dynamic Learning Environment and is mainly addressed to students, programmers and education theorists. When used as a verb, it describes a practice of casually exploring a subject. A distinct benefit is that the individual can easily create an online learning environment using little effort, offering options to enrich it further with new

perspectives and creativity as the course progresses. Moodle is consistent to those involved in online education (students and teachers alike).

Moodle is copyrighted Open Source software (under the GNU Public License), which means that you are allowed to copy, use and modify Moodle provided that the user agrees to (1) provide the source to others, (2) not modify or remove the original license and copyrights, and (3) apply this same license to any further developed components.

The main idea behind Moodle is its “activities” and “resources”. More than 20 different types of customizable activities are available (forums, glossaries, wikis, assignments, quizzes, polls, SCORM⁶ players, databases, etc.). Assigning activities into sequences and groups is the main power of Moodle’s activity-based model. That way participants are guided through learning paths permitting each activity to build on the outcomes of previous ones.

A wealth of other tools is available making it easier to build communities of learners, like blogs, messaging, participant lists, grading and reporting. Integration with other systems is also possible (*About Moodle - MoodleDocs*, 2012).

Moodle attempts to support a Social Constructivism learning environment. Hodson (1998) tells us that software such as Moodle, also Blackboard, transform the current model that favors individualism (i.e. an instructor sets up an activity, such as a formative exam, and each student has to take this individually to test their grasp of the taught concepts) to a richer environment that offers activities

⁶ According to *SCORM Explained* (2013) SCORM is a set of technical standards for e-learning software products. A SCORM editor is an editor application technically oriented toward assisting eLearning developers to develop eLearning Programmes.

that provide with social constructivism abilities such as wikis, where all students and possibly the instructor contribute to the creation and development of knowledge. Hodson (1998) states:

“A shift in emphasis from personal construction by individual learners towards social construction within the community of scientists and to a view of learning as a process of enculturation - as propounded by Vygotsky - is advocated. Such an approach would require purposeful teacher intervention.”

So Hodson concludes that eventually, it all lays with the instructor, and that is no different with Moodle. Moodle, like Blackboard, provides with all building blocks to create all types of different constructivist tools, however, it does not provide the final product. Somebody has to actually build or at least introduce the foundations of the applicable learning method, so learners may start using it to build knowledge for themselves and their peers in the group. So, the reality faced, once again, in order for these tools to be put into actual, meaningful, constructivist operation, trained instructors need to be involved. However, this is no simple training. An LMS course builder not only needs to be technically equipped and trained thoroughly in the particular platform chosen, but also needs to have deep knowledge on learning theories and probably some teaching experience to have the understanding required to build a course that will also consider constructivist specifications.

Finally, Moodle as Open Source software comes with no purchasing costs and no requiring license fees. Support however is required and it does not come for free. Moodle.org supports Moodle through Moodle courses, forums, documents, etc. backed up by the community. Moodle basically uses itself to support the application. Consequently, there are all kind of courses and learning tools with the forums on top of all.

Nevertheless, by installing Moodle there is no on-site support, nor any 24/7 technicians available to offer assistance at any time. That may be a drawback, but usually with eLearning platforms there are no frequent emergency matters to resolve compared to other systems such as banking or ecommerce. On the other hand, the forums are attended by a large community which responds surprisingly fast, providing answers and solutions.

These solutions are in many cases far better, more condensed and more complete than commercial support. This response quality can be justified by the fact that forums are community based tools, so the answers you receive are not necessarily coming from the side of the Moodle technical developers but mostly from moodlers, users of Moodle that have built courses and have encountered similar problems with yours. These are, in many cases, teachers that have mastered the application. They were inspired by the vision of computer based collaborative constructivism, and have implemented courses. Such people are the ones to offer the solutions to most of the challenges encountered.

Still, it is acceptable for a Higher Education Institution, not to feel secure by having its core eLearning application not officially supported by a group of specialists instead of the community and available documentation. Such support is available by several organizations from which some, called Moodle Partners, have been officially authorized to provide service and support to Moodle installations all over the world (*Moodle.org: Support*, 2012). Of course, such services are commercial and do not come free.

Moreover, it is noticeable to reference here, that only recently Blackboard acquired two major such support companies, Moodlerooms in United States and Netspot in Australia (Dawson, 2012). One can interpret this action as

Blackboard's willingness to get a share of Moodle support market as a means to compensate for the market loss that Moodle spreading has cost to Blackboard (Dawson, 2012). It also means that the commercial Moodle support is an important market, large enough to constitute an investment option equal to Blackboard support. This should provide higher education with the sense of security that commercial support may require.

Furthermore, Moodle is the creation of Martin Dougiamas who has postgraduate degrees in Computer Science and Education (Dougiamas, 2012). Moodle, having been developed by a person with background in both Computer Science and Education, reflects an extra advantage in providing a support community environment lead by someone that may rapport with respect to both technical and learning challenges.

Finally, the surprising expertise of teachers from all levels of education in technical issues, needs to be acknowledged. They have offered not only their expertise in building, implementing and testing on-line courses, but also their willingness to provide insight from their personal experience in using the platform for their classes no only to the technical level, but also for educational matters with regards to constructivist learning, thus making the installation of Moodle and the implementation of learning activities for the purpose of this research possible.

Possibly this is an important reason behind the decline of the commercial platform Blackboard compared to the strengthening of Moodle's market share (Browne *et al.*, 2010) along with the powerful advantage of non-existent fees with the exemption of commercial support where required.

Conclusions for Blackboard and Moodle

In both cases, the environment is a generalizable platform that may be used as a foundation to build a large variety of content to suit almost any purpose. This leads to what has been generally accepted by education as an eLearning tool, thus satisfying the definition of Kommers & Jonassen (Kommers and Jonassen, 2001) about cognitive learning tools. But the fact that the tools provide foundations to build, does not predetermine what is going to be build. So even if users of such tools may eventually have the right environment to build cognitive modules, the question is whether they know what to do with it and also whether they have the time required for the task. So, it seems that building eLearning content and applications is neither easy nor obvious. In fact, you may need to combine several attributes with respect to expertise in order to consider a successful implementation. As a conclusion based on the above findings, the following attributes have been summarized:

- Learning (pedagogy) expertise: The eLearning module developer must understand the principles of cognitive learning in order to be able to design such eLearning activities.
- User Technical expertise: For the vast majority of eLearning activities, technical specialization like programming is not required. LMSs like Blackboard or Moodle are complex applications. Although their environment is designed to be as user friendly as possible (Kommers and Jonassen, 2001) and applies to educators with no technical expertise or background, still does not suggest a preferred platform in order to offer a wide variety of options and the flexibility to create learning building blocks for all kind of different learning requirements. Users of such tools need training and

investment in time to experiment with the various choices offered. As described in Paulus's case study (Paulus *et al.*, 2010), training required is both complex and time consuming while there is not enough experience acquired by trainers so it can be considered as partially experimental. Unfortunately, both training and time cost money.

- IT services know-how: In most educational institutions IT services have technical expertise in installing and maintaining hardware, software and networks, but they are not specialized in eLearning applications. At Deree-The American College of Greece, the Information Resources Management (IRM) department, while seeking guidance from faculty, is treating Blackboard as a Course Content Management System. As a result, whatever is built throughout a semester is initialized during the next one and prohibits learning developers from building any actual progressive learning activity. Just consulting faculty that either have no strong IT background or none at all, while at the same time have not received any specialized training on the particulars of the installed platform seems not to be working.
- Cost of purchase: Should the organization choose to acquire a commercial eLearning platform they will find that the investment involved is quite expensive. An average installation of Blackboard is a serious, non-negligible cost while maintaining the license plus technical support may incur a significant amount of money spent annually. Those kinds of costs during these times of crisis, at least in Greece, constitute a serious financial bleeding for the organization and since this decision refers to a long term strategic plan it may need to be considered seriously before renewed.

- Cost of maintenance: Personnel, hardware and software running expenses to maintain such applications on 24/7 basis.

2.6.3 Other eLearning Software

Capterra provides directory, articles, infographics and guides services that assist organizations in finding the right software. In their 2016 survey for ranking general LMS software based on its customer installations (*Best LMS Software, Reviews of the Most Popular Systems*, 2016), Moodle has surpassed Blackboard in the 2nd position while it worth's mentioning Edmodo, not so popular at the beginning of this research, occupying the 1st place. Empirically, Edmodo seems to be more appropriate for secondary school students providing a simple environment that does not seem to require any specialized IT experience and limited enough to not require extensive pedagogical expertise. Its placement in the 1st place is based on evidence derived by educational implementations at all levels of education and not exclusively from Higher Education which is mostly dominated by Moodle and Blackboard. Overall, it seems to follow the well-known mainstream logic of popular social networks. These are possibly the strongest reasons behind its popularity. However, Edmodo does not provide the variety of tools nor the possibility to address complex constructivist activities suitable for higher education and corporate training.

Finally, the number of installations drop dramatically with respect to the software occupying the positions below Blackboard, while more or less the functionalities supported have not presented any important innovation to discuss. Some additional software, with already enabled activities is mostly offered by publishing companies specializing in the area of education like McGraw Hill Education. These web-based services mainly offer online interactive tutorials, formative

assessment management software and web eBook management services such as Simnet Online Course Manager. Such services however, are somewhat popular as complementary to the institutional learning platform such as Blackboard and Moodle while their content is specific to the publications of their vendor, in this example McGraw Hill Education offering Simnet content for Microsoft Office which is related to one of their introductory IT eBooks (*Computer Information Technology*, 2016).

2.7 Conclusion

In this chapter, learning models were studied to form a basis of understanding how learning works. Additionally, information technologies and specifically eLearning were examined to have a general understanding of the possibilities and the influence that technology offers to learning. Understanding learning and furtherly examining TEL options and implementations is part of the followed inductive logic followed aiming to understand any challenges that may occur in implementing technologies that will determine the course of the thesis. An additional aim was to explore if technology can further on assist the manifestation of learning theories and concepts. The goal was to identify the opportunities among the causes of such challenges that assisted in formulating the novel contribution of this thesis.

Positivism and constructivism were elaborated in terms of theories of learning and linked to the Bloom's taxonomy in order to appreciate and promote higher forms of thinking in education, such as analyzing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts. Tools and methods of learning were examined concluding with mobile learning and their adaptation to the STAR legacy model (See Appendix X).

The conclusion deducted from this part of the research is that most positivistic methods may be well and easily adopted by technology. Additionally, for constructivist methods it seems that eLearning is suitable to assist in the process of constructive learning by providing a variety of interactive knowledge generating activities. Such technology, in order to meet or at least satisfy some of the expectations of all involved parties of higher education (students, instructors and administrators) should have the following characteristics: It should meet the budget limitations of the institute. It should be simple and easy to learn without requiring and intensive training or any training at all. It should not require too much time to perform an action (like interacting to activities). It should be easily adopted. It should be ubiquitous in order to also be accessible by distance learners who are a target market for higher education institutions. Furthermore, it should be able to handle multiple contents and media used for learning. The fact that most tools of learning were not initially designed or at all for learning seems to be a drawback mostly for constructivist implementations. Although the benefits of technology such as availability, accessibility and ubiquity are obvious it may also be assumed that they may be difficult to be properly implemented and non-adequate to achieve the expected productivity. Because of these benefits it seems that all people may have access to knowledge manifested in various pedagogical forms without restrictions like geographic location, time-zone or content as long as they have access to a PC and Internet. It is left to people to take advantage of these opportunities, engage with learning implementations and become learners.

Based on the literature review so far, it could be stated that the next step in TEL may not just be another information technology that would again offer a slightly

alternative, possibly more enhanced way in implementing learning methods but a technology that will serve and enhance the existing ones, offering benefits to all related learning models.

Considering all, it is quite evident at this part of the thesis that new learning technologies, by combining the various learning models and theories and integrating them into the modern tools and available services can offer a significant improvement to learning if it succeeds attracting and sustaining learners. That means that if learners do not use the offered technologies, none of these benefits, irrelevantly to what is the related theory or model behind it, will succeed in its goals. Consequently, if learners actually use the available technologies and even better if they adopt them into their daily habits similarly, for example, to social networking, they will receive the maximum benefits from it.

3. Current State of eLearning Applications in Higher Education

Having briefly covered in Chapter 2 learning methods and their major technological implementations, chapter 3 focuses on the currently implemented technologies in education and their contribution to learning.

3.1 Recent eLearning Trends

According to Allen and Seaman (Allen and Seaman, 2010), 74% of the public Institutions in US, 51% private for-profit and 50% private non-profit institutions support that online learning is a serious long-term factor of their institutional strategy. This presents an interesting evidence concerning whether on-line learning is a strategic objective in higher education. As discussed in the previous chapter, evidence concerning faculty show that while the number of programmes and courses online continue to grow, the acceptance of this learning modality by faculty has been relatively constant since first measured in 2002. More specifically, less than one-third of chief academic officers believe that their faculty appreciate the value and importance of online education and this is the case for more than five years. Although the level of this belief is different between types of schools, there are no cases where chief academic officers believe that eLearning has been fully accepted by their faculty (Allen and Seaman, 2010).

So, despite the fact that many administrations believe their faculty does not fully recognize the value of online learning with some non-significant variety depending on the type of the educational institution, on-line programmes keep growing.

Finally, from the same report, the following facts are derived:

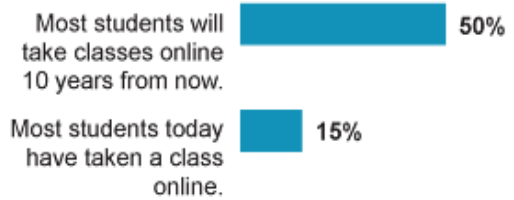
There is a variety of approaches taken by institutions with respect to training sessions for their instructors. Most institutions combine several training practices. Nevertheless, 19% of institutions that offer online courses reported that have not offered any training sessions for their instructors. Furthermore, the most common training options used for online faculty mainly include internally run training courses (65%) and informal mentoring (59%) (Allen and Seaman, 2010).

An empirical three-year experience gained by deploying a full-scale eLearning platform (including hosting, installing, setting up, software customization and finally developing courses and eLearning modules), indicates that without proper training it would be a utopia to believe that faculty will self-train themselves to the level required to implement the learning methods discussed previously in this report. This process will be even more challenging for faculty with no IT background. The constraints explained above bring a challenging question of how faculty without technical background - preoccupied also with research projects and administrative obligations on top teaching assignments - may take full advantage of these technologies. Training and expert instructional designer support seems to be an answer (Hudgins, 2009).

Additionally, Parker, Lenhart and Moore (2011) reveal some interesting facts about the higher education industry in United States that may be seen in Figure 6.

Percentage who say online courses offer an equal value compared with courses taken in a classroom:

Note: General-public figure is from a telephone survey conducted on landline and cellular phones March 15-29, 2011. College-presidents figure is from a Web survey conducted March 15-April 24, 2011.

Percentage of college presidents who say:

Source: Pew Research Center/Chronicle of Higher Education Survey

Figure 6: College Presidents' opinion about online courses (Young, 2011)

Subsequently, what this evidence tells us is that most education administrators believe that their faculty does not fully recognize the value of eLearning applications in order to offer on-line courses. In fact, not only there is no evidence on what the faculty actually believes, but also how and to what extent they actually use eLearning platforms and what is the impact to students. So, this is an area that needs further investigation that might lead to answers related to faculty engagement possibilities with eLearning. However, evidence shows that there is certainly a trend towards the implementation of such applications in higher education anyway. Additionally, research indicates that this trend is created mostly by educational administrators and not educators, as indicated on Figure 6. The general public also seems to believe in online course modules but at a much smaller percentage compared to chief administrators of educational institutes. The research from which these evidence originates is based on a survey that aimed college presidents in United States as its source of input. The sample refers to top level administrators who although may have had some faculty experience in their career, this is not necessarily a fact. According to Parker, Lenhart and Moore (2011), just over 50% of the queried presidents (a sample of 1,055 presidents were interviewed in this survey) believe that online courses offer the same value with traditional classes. This brings the question on

what is the driver that leads higher educators towards investing to on-line learning solutions. Young (2011), reveals that the truth lays behind the fact that more and more educational institutions desperately need to reduce their budgets by extending their reach to more students who need more convenient options for their education. As Britain (1999) reports, a major contribution that is offered by eLearning platforms is that they combine a resource cost effective approach while at the same time relieves instructors for extra administrative tasks.

Bourner (1997), predicted that in the future class sizes will become larger per instructor across most courses, while small classes will just be an insignificant fraction of the total courses offered by educational institutions. According to Bourmer's (Bourner, 1997) argument, this will become a fact because institutions will re-engineer their courses, having the financial contribution per student as their first priority and last any work related to low contribution. Hence, large audience and distance learning classes will be favored against learning activities or content aiming small groups or individuals. Work done for classes during the first two years of students' studies is considered of relatively high financial contribution due to the larger number of registered students for these classes. Work done to support undergraduate studies for the remaining years and possibly graduate or research studies is in many cases of low financial contribution and usually requires much of the institution's innovatory teaching and learning initiatives. Educational institutions will benefit much by using technology to maintain the quality of learning while reducing its cost especially for such classes. According to Laurillard (2002) universities are like live organisms and treated as such need to adopt to their environment in order to survive. Therefore, administrative decisions related to cost factors should be expected to be major

drivers of the change required to adopt and survive in the educational ecosystem or market. However, since the product is “learning”, the institution should be capable of adaptive learning in the sense that educational methods need also to adopt to the requirements of the environment. Learning technologies seem to offer a powerful tool that may assist in that direction.

Based on EDUCAUSE report, “The greatest benefit of e-learning remains unchanged since its inception: It can increase enrollment by increasing access.” (Bichsel, 2013) This is certainly a major advantage when viewed from an administrating point of view while it fully supports the evidence provided by Pew Research in US but also Bourner’s predictions (Bourner, 1997; Parker, Lenhart and Moore, 2011).

Bourner, extends his argument to state that Internet offers the technological background for disseminating information to such a level that may eventually replace traditional in-class teaching in their role to convey knowledge. However, it seems that current eLearning implementations do not exactly cover the expectations of students (Bichsel, 2013). Although it seems that eLearning clearly achieves to reach student populations that previously had limited access to learning content and activities and lowers down storage cost by digitizing such content, according to Bichsel, students would expect more constructive activities such as gaming and simulations which seem to be rarely found in higher education eLearning systems.

Taking a further step, Bourner reports that many - if not most - universities teaching campus based courses, will not survive against the competition especially from more prestigious universities that offer, possibly lower in quality but definitely much more cost effective, online courses (Bourner, 1997).

Obviously, it has to be admitted that predictions like this may be possible in the near future, while currently there is an obvious trend towards this direction that justifies the haste in president's willingness to invest on online technologies.

Taking all of the above into consideration, learning goals are not a matter of better educational practices or technologies, but mostly choices based on socioeconomic reasons. One may argue that these reasons may reflect only to distance learning courses and still they are a bit blur to guarantee for the validity of the predictions. Still, considering Figure 6, it may be seen that the new trend behind online courses is to possibly replace traditional in-class education with online which will certainly be a cost cutter. However, something like this may become feasible taking into account possible compromises. Opinions from representative higher education leaders like Kenneth E. Hartman, president of Drexel University Online, *state that "most college presidents have never taken an online course and have little sense of what's involved."* (Young, 2011)

Lack of knowing what is involved may possibly cause decisions that may possibly lead to average or opposite results. Besides the fact that students prefer blended learning (both eLearning and face-to-face contact) according to ECAR (Dahlstrom, Walker and Dziuban, 2013) should strongly be considered despite the financial discomfort it may incur to Higher Education institutions. According to Browne et al. (2010), UCISA ⁷ report the awareness of several related to LMSs issues which have a notable impact on Computing and/or Information Services. It has also identified challenges related to both faculty and students that have

⁷ UCISA: Universities and Colleges Information Systems Association, University of Oxford. *167 institutions as defined by the home countries Higher Education Councils were invited to complete the Survey. This represented the same population which was targeted for the 2008 Survey, of which 132 institutions were located in England, 13 in Wales, 18 in Scotland and 4 in Northern Ireland.*(Browne et al., 2010)

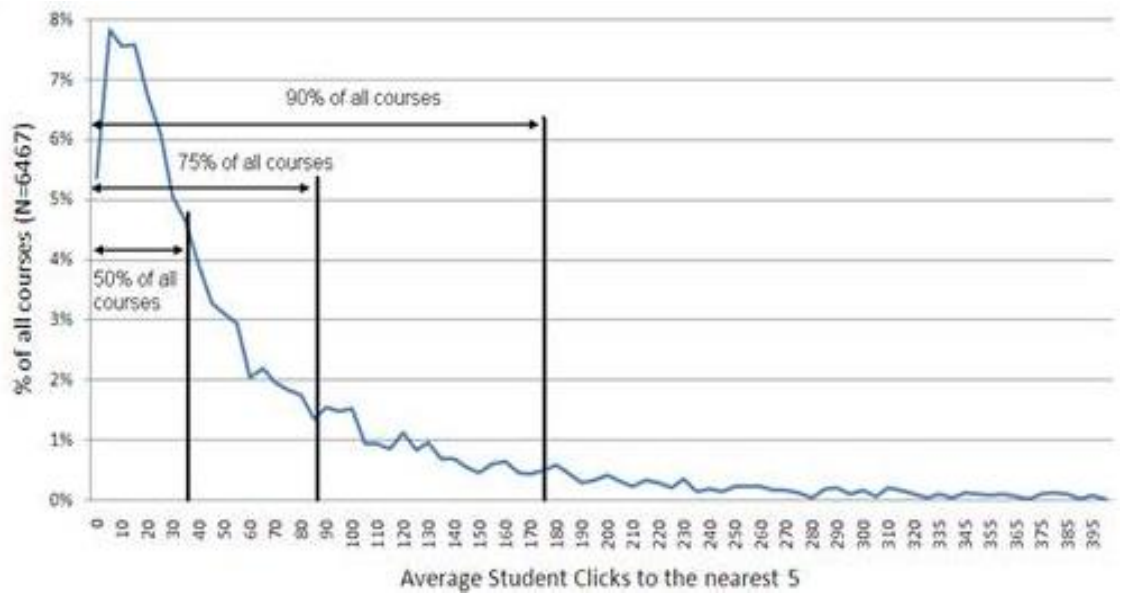
cultural origins with respect to how they both address learning and teaching. Specifically, for LMSs issues also refer to their implementation, technical support and all other support and required pedagogical knowledge that comes with building and implementing learning activities.

It seems that according to the *2010 Survey of Technology Enhanced Learning for higher education in the UK*, the major obstacles, are still related to money, time and faculty knowhow with time still been the top barrier (Browne *et al.*, 2010). This has also been identified in the corresponding 2008 survey.

Evidence that support the impact of the above mentioned weaknesses related to the implementation of LMSs, is provided in Dr. Demetra Katsifli's (2010) report. According to this report, administrative functions including reading announcements and submitting coursework constitutes a significant 50% of the student activity in LMSs. Dr. Katsifli goes further by mentioning other studies which support the administrative use of LMSs by exhibiting students placed value in submitting coursework online.

Furthermore, according to Griffiths (2009), more than 50% of the courses offered at BYU⁸ during 2004-2005 used Blackboard., However most of them had a low level activity both by students and instructors.

⁸ BYU: Brigham Young University



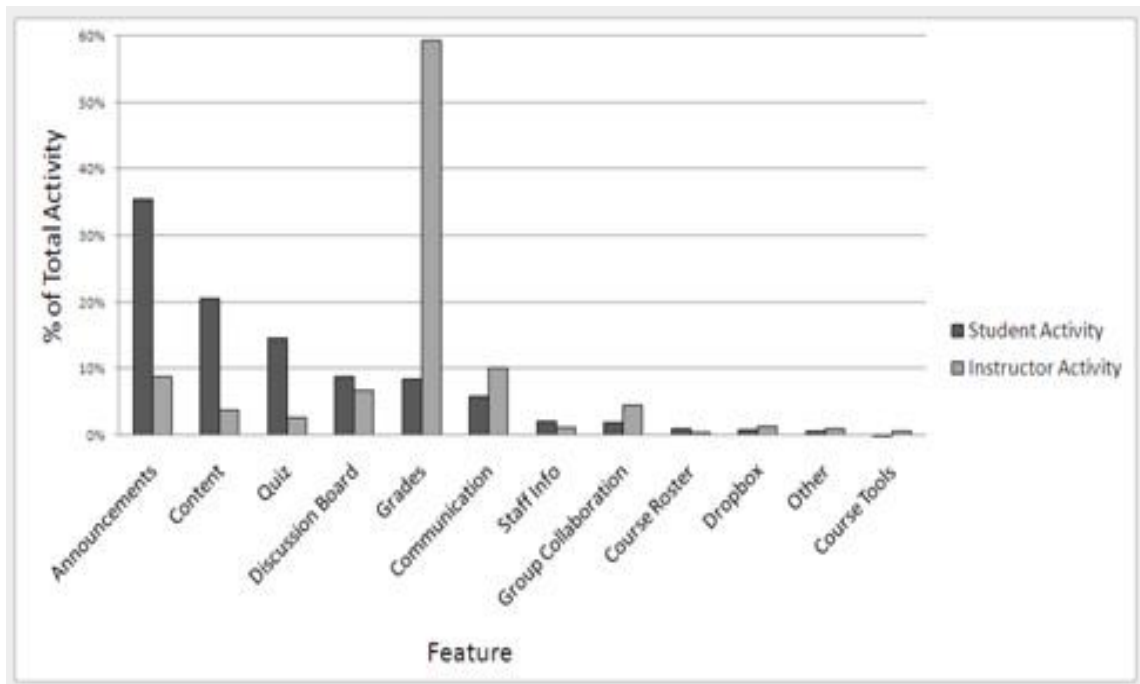
Source: (Griffiths and Graham, 2009)

Figure 7: Average student clicks as a percentage of all courses. This shows that 35% of all courses had average student clicks of 35 or less.

Figure 7 shows that there were some few exceptions with respect to some courses which exhibited a high average activity on behalf of students.

Moreover, clicks do not necessarily prove engagement with the eLearning activity. Empirically, it is known that people frequently click “next” for example just to move on to the next stage without having examined the stage they currently are. However, many clicks compared to no clicks at all, provides indication of possible engagement with some of the researched courses in Figure 7. That might be related to better trained or more actively involved instructors or just luck. Those facts signify that further research is required to understand what has enabled this behavior in these cases.

Further on, in the same survey by Griffiths (2009) as exhibited by Figure 8, the visitor activity tops in mainly three features out of the twelve analyzed by this report. These are Announcements, Grades and Communication which are mainly administrative features. So it seems that although administrative areas of the platform are very popular, learning areas like group collaboration and discussion boards are much lower in preference. The reason behind this may lie to the fact



Source: (Griffiths and Graham, 2009)

Figure 8: Student and Instructor activity in different features as a percentage of total activity

that learning areas are promoted as repositories instead of engaging students to an interactive constructivist model of learning. At the same time, what needs to be determined is whether the constructivist activities build will result in students' engagement?

In the context of the above raised concerns, two surveys have been conducted. Their purpose was also to explain why students seem not to be using the actual learning contents rather than the administrative content. These surveys will be discussed at chapter 4.

Although the above surveyed functions, Announcements, Grades and Communication, are very convenient for probably students, administrators and instructors, but at least the first two, are far from what has been established to be a learning environment. Still, half of the students mostly use Blackboard for such tasks. According to Katsifli's (2010) analysis, the use of forums, which offer an

interactive constructivist learning environment⁹ for engaging with online (but not real-time) discussions, are also in the high interest of students as long as they are under the leadership and guidance of their instructor. So, the question that needs to be answered here relates to the students' low involvement with collaborative eLearning activities. Based on Katsifli's (2010) analysis, the reason behind the general low participation numbers concerning such activities may be that instructors have not assumed the leading role expected for these activities to flourish. For such eLearning activities to succeed, it is expected that instructors as the leaders of the course, not only have designed and implemented a forum but they have promoted or required its use in class. Additionally, they have promptly responded to any activities that may have consequently occurred. Based on such modules implemented in courses during the last 8 years at Deree College, it seems the above described actions may lead to some engagement increase. However, substantial engagement increases were observed in cases where summative assessments were related to or used such implementations in combination to such actions. For example, creating a project support forum and instructing students to post questions for their project only there. Additionally, tell them that questions received elsewhere will be ignored. In my experience, students will begin to send questions via email and most frequently these days via Facebook messenger. At this point the student needs to be directed back to the forum if an answer is to be given. By insisting on this policy, the forum starts to become live.

⁹ Any eLearning activity that implements a constructivist approach for learning where interaction between students with other students, the instructor or the eLearning application is available or even required.

As a next step, it is considered helpful to re-examine the learning aims of higher education as shown in Table 1.

1	2	3	4	5	6
Disseminate knowledge	Develop the capability to use ideas and information	Develop the student's ability to test ideas and evidence	Develop the student's ability to generate ideas and evidence	Facilitate the personal development of students	Develop the capacity of students to plan and manage their own learning

Source: (Bourner, 1997)

Table 1: Learning aims of Higher Education

Current eLearning technologies, mostly LMSs, offer the foundation for instructional designers to deliver online courses, blended or not, that largely meet the above aims subject to constraints mostly related to budgets.

Irrelevantly to the use of technology, common teaching methods used to implement higher education aims are listed in the following table:

	1	2	3	4	5	6
	Disseminate knowledge	Develop capability to use ideas and information	Develop the student's ability to test ideas and evidence	Develop the student's ability to generate ideas and evidence	Facilitate the personal development of students	Develop the capacity of students to plan and manage their own learning
Ten common teaching methods	1. Lectures 2. Up-to-date textbooks 3. Reading 4. Handouts 5. 'Guest' lectures 6. Use of exercises that require students to find up-to-date knowledge 7. Develop skills in Using library and Other learning resources. 8. Directed private study. 9. Open learning materials. 10. Use of the Internet	1. Case studies 2. Practicals 3. Work experience 4. Projects 5. Demonstrations 6. Group working 7. Simulations (eg. Computer based) 8. Workshops 9. Discussion and debate 10. Essay writing	1. Seminars and tutorials 2. Supervision 3. Presentations 4. Essays 5. Feedback on written work 6. Literature reviewing 7. Exam papers 8. Open learning 9. Peer assessment 10. Self-assessment	1. Research projects 2. Workshops on techniques of creative problem solving 3. Group working 4. Action learning 5. Lateral thinking 6. Brainstorming 7. Mind-mapping 8. Creative visualization 9. Coaching 10. Problem solving	1. Feedback 2. Experiential learning 3. Learning contracts 4. Action learning 5. Learning logs 6. Role play 7. Structured experiences in groups 8. Reflective documents 9. Self-assessment 10. Profiling	1. Learning contracts 2. Projects 3. Action learning 4. Workshops 5. Mentors 6. Reflective logs and diaries 7. Independent study 8. Work placement 9. Portfolio development 10. Dissertations

Source: (Bourner, 1997)

Table 2: Teaching and Learning methods for different learning aims

One can easily spot areas that may immediately be enhanced by implementing eLearning platforms. Most LMSs, including Blackboard and Moodle, offer content management and storage, learning activities and collaboration environments to enhance all these aims. How many of those tools can or are actually put into operation is discussed further on at the survey findings in chapter 4. In fact, in many course modules, several of the above referenced teaching methods are not implemented traditionally. The reason behind this lies to administrative logistics

which usually involve time and money. For example, at Deree College, in a course that it considered useful to include lots of exercises, presentations, case studies or even a couple of role-playing sessions, the 38 teaching hours in total for course completion pose a serious time limitation.¹⁰ In fact, the time may just be enough to satisfy the first aim of learning by just delivering lectures and maybe some exercises. It was only recently that administration has required that practical lab sessions supporting a module, are to be reduced by half to make the course financially more attractive to students.

One major challenge in higher education is the rising levels of class contact (*Workload protection*, 2016). This is due to current financial strategies of institutions which provide limited resources to cover larger groups of students (larger classes) compromising not only instructor's scholarship and research but also essential interaction with students. (Bourner, 1997)

The quick answer is that time and/or cost logistics prove, that courses would not have been feasible any other way. At the same time based on the work of Open University and Birkbeck College, Bourner (1997) argues that it is quite evident for distance learning to effectively provide the means to propagate the information required for producing graduate and postgraduate students. Considering all, higher educational institutes have largely adopted eLearning but still there is no evidence that this had any extra positive effect to students that used such technologies either to complement campus learning or through distance learning (MacKeogh and Fox, 2008). Some educational staff is skeptic with respect to the quality of delivered learning, the workload involved and control of learning

¹⁰ Based on the implementation Deree College scheduling of modules validated by the Open University, UK under the *Quality Assurance Agency* for Higher Education of UK.

activities through eLearning. At the same time there are equally enough educators that recognize the value and the need of eLearning and positively welcome such implementations (MacKeogh and Fox, 2008). So, as a conclusion, it may be said that the reduction of face-to-face contact hours caused by the introduction of eLearning has not yet been observed to have neither a positive nor a negative effect to learning. Thus, their cost-effective advantage justifies their administrative favoritism without any identifiable educational sacrifice.

3.2 Trends and the Future of eLearning

As technology evolves, new innovations are made available, providing options and solutions not only for the problems of current implementations in eLearning but also enhance learning in ways that were never possible in the past.

3.2.1 Cloud Computing

Cloud computing, a revolutionary Internet technology option, offers a way to off-load the costly and demanding on-campus hosting of LMS to third party data centers based on the requirements of each institution. According to Nagel (2012), Washington State Board for Community and Technical Colleges which is comprised by 34 educational institutions, have started to migrate their on premise LMS systems to cloud based ones, specifically Instructure Canvas. Canvas differences from most other LMSs do not have to do with content but mainly with its technical options that derive from the fact that it is a cloud based only, Open Source and User Friendly LMS. A graphical comparison between the major in-campus hosted LMSs and Canvas is depicted in Figure 9. Since the cost of implementation and maintenance of an LMS poses a major barrier in learning,

cloud based LMSs such a Canvas, may assist by offering an alternative to the financial dead-end that Higher Education institutions face.

		CANVAS	BLACKBOARD	DESIRE2LEARN	MOODLE (MoodleRooms)	SAKAI (rSmart)
ARCHITECTURE	Native Cloud Service	✓	✗	✗	✗	✗
	Automated Peak Load Management	✓	Manual (hosted)	Manual (hosted)	Manual (hosted)	Manual (hosted)
	Development Technology	Ruby on Rails	Java J2EE	Microsoft .NET	PHP	Java
OPENNESS	Software Licensing	✓ Open Source Commercial / AGPL	✗ Closed Source Proprietary	✗ Closed Source Proprietary	Community Backed GPL	Community Backed ECL
	Open API	✓	✗ Fee Based	✓	✓	✓
	Annual Open Security Audit	✓	✗	✗	✗	✗
FEATURES	Standard LMS Functionality	✓	✓	✓	✓	✓
	Integrated Learning Outcomes	✓	Fee Based	✓	✓	✗
	Mobile Applications	✓	Fee Based	Fee Based	Version 2.1 Only	✗
USABILITY	Ease of Use ¹	✓ 4.12	3.27	3.02	✗ 2.47	3.05
	Accessibility (NFB Certified)	✓ Gold Level	✓ Gold Level	✓ Gold Level	✗ Not Certified	✗ Not Certified

Source: [39]

Figure 9: Instructure Canvas comparison with other LMS

Although Moodle and Blackboard are still the most popular LMSs, there seem to be a shift from campus operated LMS to Canvas. Figure 9 compares Canvas, which is cloud based, against the most popular campus based LMSs. Canvas offers many benefits against some of the other LMSs but differentiates from them by being cloud-based which outsources storage and technical support reducing costs. Canvas is used as an example that indicates a trend. Cloud computing offers additional very important benefits. Ubiquity and a wide variety of web-based applications that can be used or combined for learning. The ability to create Application Programming Interfaces (APIs) that may increase the functionality and/or efficiency of applications like Canvas but also non-cloud based ones. Finally, it offers scalability of processing resources to adjust to the possible

demand requirements of Mobile Learning (mLearning) or other educational implementations (Gonzalez-Martinez *et al.*, 2015). Since technologies constantly evolve, both Blackboard and Moodle have started to offer cloud services through SaaS providers¹¹.

Considering all, there is a strong indication that cloud computing will possibly play an important role to the shaping of modern education technological implementations.

3.2.2 Social Networks (Social Media)

Over the last years, computer mediated social networks and especially Facebook have achieved an impressive engagement by the users of the Internet. Such engagement is witnessed not only to students but also to instructors. In fact, it seems that students using social networks to communicate with their peers are exposed to more options leading to the development of personal relationships compared to the traditional face-to-face communication (Mazer, Murphy and Simonds, 2007). The same fact is supported by Christina Decarie (2010) who reluctantly started to communicate with her students using Facebook. Besides some challenges she encountered, soon Decarie realized that for students Facebook is a major means of communication, not only with peers, but also to promote their ideas and even their careers. Hence, it may serve as an educational ground for the implementation of the knowledge taught in class. Mazer et al. (2007) argues that the use of CMC¹² may achieve better results on the student-instructor relationship, which in turn may lead to more successful outcomes in relationship with learning. So, what is different between Facebook and a

¹¹ "Software as a Service (SaaS) is a **cloud** model that delivers on-demand applications that are hosted and managed by the service provider and typically paid for on a subscription basis" (Sullivan, 2014).

¹² CMC: Computer-Mediated Communication

traditional instructor's site? According to Mazer (2007), Facebook is distinguished from other Social Networks because it achieves to connect faculty with students across the academic community, while a traditional instructor web site would require an affiliation with the particular institution where the student has access. At the same time, Facebook has already, within its community, the vast majority of students while around 297,000 faculty members have already an account in United States (Mazer, Murphy and Simonds, 2007), a number that has most probably largely increased not only in the US but in most countries by now.

Based on surveys conducted as part of this research (Chapter 4), since Facebook, is widely available among the members of the learning community, it is easier for students to locate their instructor's Facebook site compared to their university site. At the same time, all interactive Facebook features, because they are already well known to students, may facilitate a far better communication compared to the use of email, which is usually the communication service offered by instructor static sites and institutional eLearning platforms. Empirical experience depicts that there is a big difference between referencing materials in traditional LMSs and social media sites. For example, a link that is posted in the Blackboard course site, has a very low hit rate and the number of students following it is low compared to posting it on Facebook course related page. Based on the same observations, using Blackboard, in many cases, students will not see the related notification while in Facebook they will. Blackboard sends an email notification to the student for most updates of content or activities, i.e. a new test or a response to a forum post. However, in my experience, email is not the most popular means of communication among students, while a Blackboard notification might be ignored before opened maybe just because the subject is

mostly descriptive to the origin of the mail (Blackboard) and not the content. At the same time because of students' existing engagement to Facebook and also its highly popular mobile applications it is more possible for the notification to be seen. In addition to that, the responding student will get a notification about the update every time a peer group member interacts with it. So, it may be expected that there will be an increase motivation for a student to read a notification out of curiosity on why peer group members have liked it and using common sense and even higher if a fellow student shares it publicly or personally or responds to it. DiVall (2012), introduced a Facebook page and a Blackboard discussion board to compare the engagement of students to discussion and general interaction to the corresponding environments. 25% more students posted on Facebook compared to Blackboard confirming the empirical observations made above. Considering also Chou's (2010) research which shows that learner-learner interaction has higher adoption rates compared to learner-instructor and learner-interface might be a good justification of the positive effects of using social networks in education. As Shea (2010) states, social interaction and negotiation of meaning, which are actually primary functions of social networks, is supported by online environments and is in alignment with constructivist epistemology (Vygotskiĭ, 1978).

In fact the high penetration of Facebook in the Academic community led the Lookabee company to develop a platform that may be used by instructors to create Facebook applications in order to keep in touch with students proving there is interest in a market of educational implementations related to social media (Bosch, 2009). This, as a service, may be somewhat efficient but definitely not

effective, due to the redundant operations required by instructors to share eLearning updates similarly as updating Facebook course related pages.

Concluding, the high penetration of Social Networks and especially Facebook throughout the academic community (both students and instructors), may offer significant benefits in communicating course related material. These benefits cannot be ignored considering however that Facebook is not designed for educational purposes and does offer specialized eLearning content, services or activities.

3.2.3 Second Life and Virtual Worlds in Education

Second Life (SL) is currently the leading and at the same time, the probably the most evolving in terms of membership population virtual world environment (Figure 10). Second Life is the creation of Linden Lab which was founded in 1999

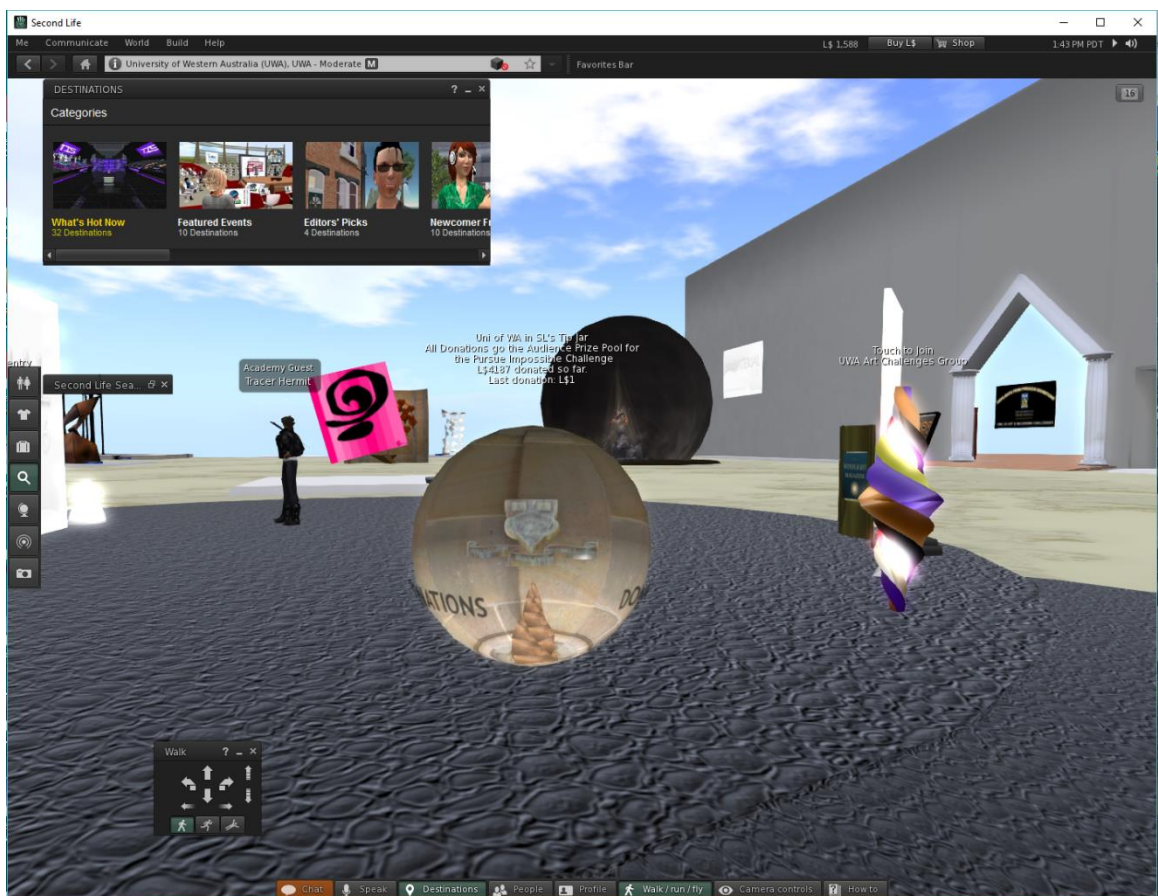


Figure 10: University of Western Australia (UWA) Art Exhibition (Second Life browser snapshot)

(Linden Lab, 2016). According to Warburton (2009), Second Life is “*a virtual world that provides an experience set within a technological environment that gives the user a strong sense of being there*”. Hence, Second Life provides with an environment where both students and instructors through specialized 3D browsers access a 3D, multiuser environment via their avatars. They are able to experience content and activities that could never be provided through the two-dimensional web based LMSs. At the same time, SL combines most of the features of Social Networks (such as status updates, sharing, chatting, etc.), thus also offering the educational benefits described in the previous section. Hence, it would be logical to assume that SL offers the technical foundation to build an enhanced constructivist learning environment, providing students with optimum learning experiences in areas that would be impossible to experience through an ordinary LMS. The University of Leicester (2012) for example, has created a Media Zoo where visitors (students, faculty or anyone else with access to SL) may access an area called Safari Park and experience how micro-climate changes will affect animals and visitors. As Jessica Shepherd (2007) reports, universities like Lancaster, Leicester, Oxford and Edinburgh have already started to experiment on SL, while according to Michels (2008), a similar and even faster trend has been observed by many American Universities which use SL to introduce complex concepts to their students (i.e. Trinity University students in media studies, design and implement promotional campaigns through SL, University of Houston architecture students implement and test business plans in the virtual world environment of SL (Michels, 2008)). So the major advantage of Second Life is that students feel as if they are physically in the educational environment along with their peers and instructors (Alenezi and Shahi, 2015).

That could be a campus classroom or any appropriate educational environment with the additional benefit that can be accessed remotely.

Although currently most educational projects on SL are experimental, according to the actual words of Livingstone (2007), *“Virtual worlds like Second Life represent the future of human interaction in a globally networked world, and students who have grown up with the Internet naturally swim in these waters.”*

At the same time, high technological activity and innovations are observed in the sector of Virtual Reality. One can only imagine the benefits of combining actual Virtual Reality with the LMS technologies. It would add the ability of placing learners at the actual spot where the knowledge resides free of the boundaries set by campus limitations. For example, learners, using virtual reality devices (e.g. goggles), could actually visit museums, cities or live historical events as if they were present (Sinclair and Gunhouse, 2016). However, currently such technologies, constitute a high investment cost while at the same time there is not enough experience or best practices for their use.

3.3 Mobile Learning

According to Alfahad's (2012) definition for Information Technology (IT) for higher education, it refers to *“personal electronic devices such as laptops and handheld computers, smart phones, and institution's computers and associated devices”*. Therefore, it is currently recognized that mobile devices are an inseparable component of educational IT. Adding to that, the advancements in technology and especially in mobile devices, definitely affect learning by offering the benefit of releasing it from its confinement in classrooms (Cavus and Al-momani, 2011). Mobile learning offers a ubiquitous model of learning, allowing learners to obtain learning materials anywhere and anytime using mobile devices and the Internet

(Ozdamli and Cavus, 2011). According to Ozdamli (2011), describes the core characteristics of mobile learning as ubiquitous, blended, portable, private,

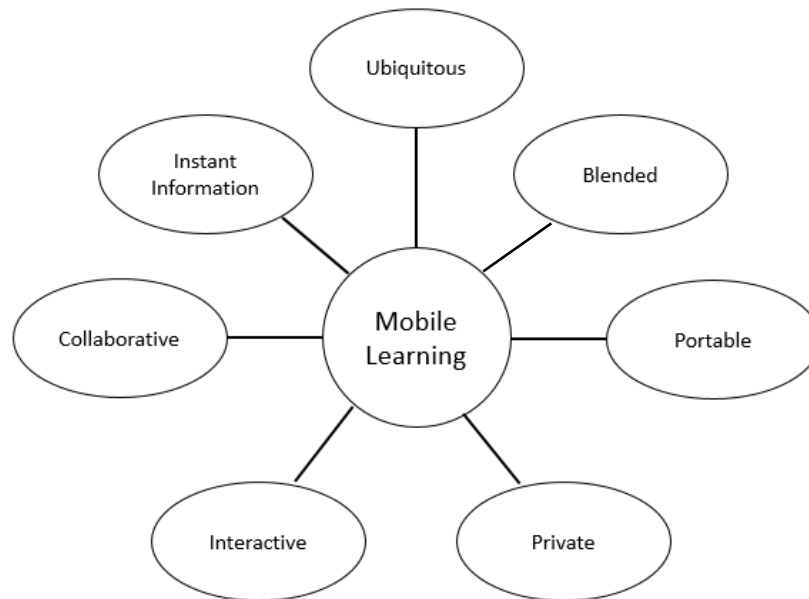


Figure 11: Basic characteristics of mobile learning

interactive, collaborative and capable of transferring instant information (Figure 11).

Cheon (2012) argues that higher education in particular, is most appropriate for integrating student centered mobile learning because of the ubiquity of mobile devices on campuses. Attempts in mobile learning for higher education mostly include examples such as students receiving evaluation and feedback from their instructors, quick response (QR¹³) codes that conveniently lead to learning content in a faster way or activities and administrative solutions such as checking absences and monitoring the grading and learning process (Cheon *et al.*, 2012). By accessing some of the most popular mobile markets (iTunes, Google Play, Amazon, etc.), it was concluded that the majority of educational applications

¹³ QR code (Quick Response code): A machine-readable code consisting of an array of black and white squares, typically used for storing URLs or other information for reading by the camera on a smartphone (Oxford Dictionaries, 2010).

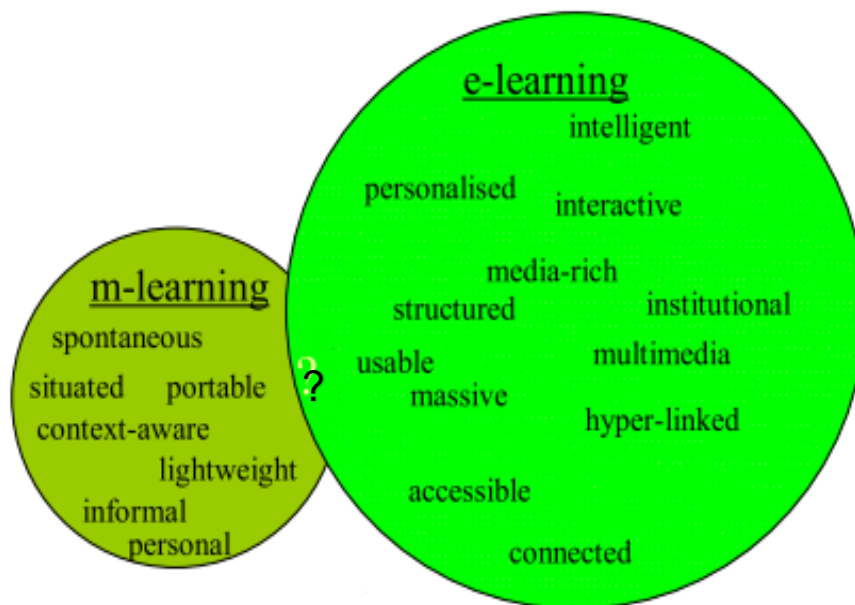
addressed to higher education do not yet focus on the actual learning process but, as Cheon observes, are mainly related to offering administrative or indirectly related services for learning. Yet the same author believes that students do have an attitude towards mobile learning that influences positively their intention to adopt it. Combining this with the fact that mobile technologies can be considered as currently the most popular information and communication technologies of the world (Gedik *et al.*, 2012), there seems to be a technological shortage. Despite the fact that a variety of applications are available which take advantage of the unique characteristics of mobile devices along with the readiness of users in higher education, these applications do not address the actual process of learning in a specific and direct manner.

Considering efforts towards mobile learning at the government level, there were four major early projects in Europe:

- The Leonardo da Vinci project From e-learning to m-learning led by Ericsson Education Dublin.
- The Leonardo da Vinci project Mobile learning: the next generation of learning also led by Ericsson Education Dublin.
- The IST project M-Learning led by the United Kingdom government under the Learning and Skills Development Agency (LSDA).
- the IST project MOBILearn led by Giunti Ricerca of Genoa, Italy (Keegan, 2005)

In all cases, these projects utilized the ubiquitous characteristic of mobile technologies in an effort to offer basic access to content repositories through mobile devices. That might have been innovative for the time those projects were deployed (2005) considering that developers were restricted by the technological

limitations of that era. This idea is complemented by Traxler (2005) where mobile learning refers to "any educational provision where the sole or dominant technologies are handheld or palmtop devices". Based on this definition, current mobile applications related to education successfully fulfil the requirements for being identified as mobile learning software. However, this study seeks to identify technologies that will directly serve and be involved in the actual process of learning. This could be achieved by either improving or increasing the interactivity between learners and the learning material already stored in various LMSs or by offering the means for learners to actively participate in the creation of knowledge. In, Traxler offers a graphical representation of mobile learning versus eLearning by comparing and combining their characteristics.



Source: (Traxler, 2005)

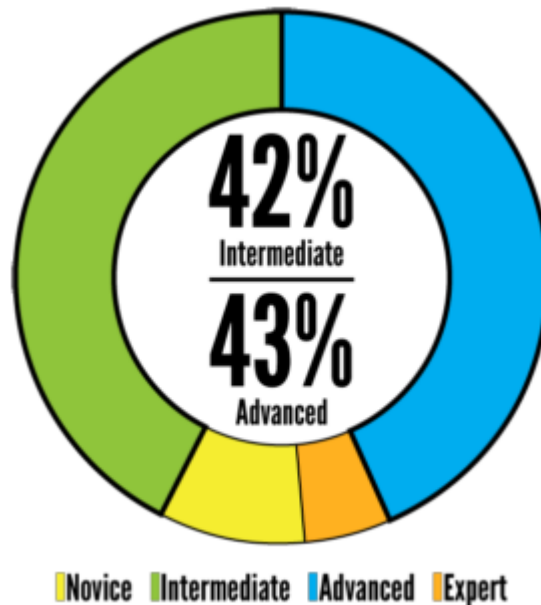
Figure 12: m-learning vs. e-learning

At the intersection of the two sets, there seems to be an unexplored area where software may be built using both mobile and web-based platforms in order to serve as bridge that will permit the transferability of the characteristics of both ecosystems. Using modern hardware and widely accepted operating systems, complemented by existing social networking (i.e. Social Media, Messenger &

Communications apps, etc.) services, a new technology may emerge that could contribute to a major advancement in TEL by integrating the characteristics of both environments, to all distinct learners and learning communities.

Although there seems to be a technological readiness for the two ecosystems to provide the grounds of enhanced mobile learning, it seems appropriate to also examine if learners are also ready to adopt such technologies. Alfahad, concluded that incorporating a new pedagogy into teaching is attributed to learners attitude or orientation towards technology (Kommers and Jonassen, 2001) after taking into consideration internal factors that influence instructor's decision towards the use of technology in teaching. Consequently, focusing on mobile technology, if the instructors have a positive attitude or orientation towards mobile technologies, they will be more inclined to incorporate it into their teaching. Considering external factors (Alfahad, 2012) like faculty demographics, age, gender, class size and institutional support, challenges are encountered related to (1) technical expertise, (2) time required to learn and use new technologies and (3) policies, procedures and support for technological issues. Similarly, internal and external factors are influencing students with respect to their attitude towards adopting information technologies for learning.

A study on student preferences for mobile app usage was made in Purdue University in 2012, indicating that students are quite familiar with the mobile environment and its use as indicated in Figure 13 (Bowen and Pistilli, 2012).

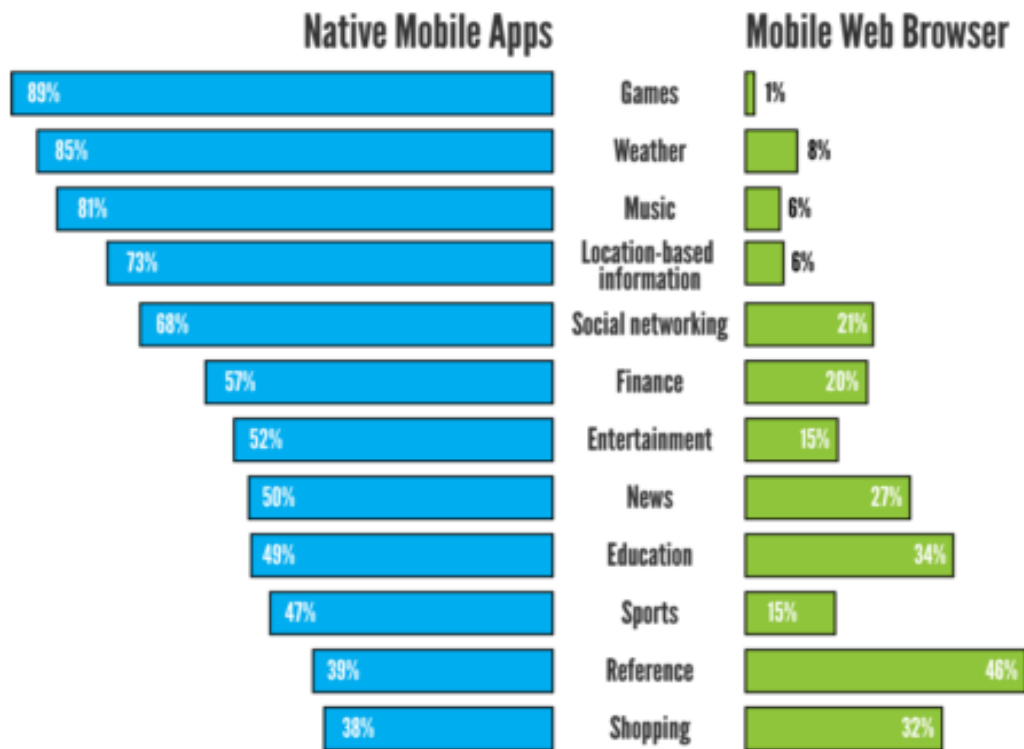


Source: (Bowen and Pistilli, 2012)

Figure 13: Level of Smartphone Usage

Based on the same survey, it seems that there is a significant preference towards using native mobile apps compared to accessing content through a mobile web browser (Bowen and Pistilli, 2012). Such preference, as indicated by Figure 14, also includes educational applications where half of the respondents prefer native mobile apps. Since the presentation of this survey in 2012, a vast increase in the in the mobile market was observed. That increase is expected to reach the impressive figure of \$77 billion revenues in 2017 complemented by 268 billion expected downloads of mobile applications (Clifford, 2014). It is expected to go up to \$188.9 billion revenues in 2020 (*Mobile app revenues 2015-2020 | Statistic, 2017*).

Hence, it is safe to say that the mobile ecosystem is already used enough and therefore is already adopted by the majority of students. This may lead to the

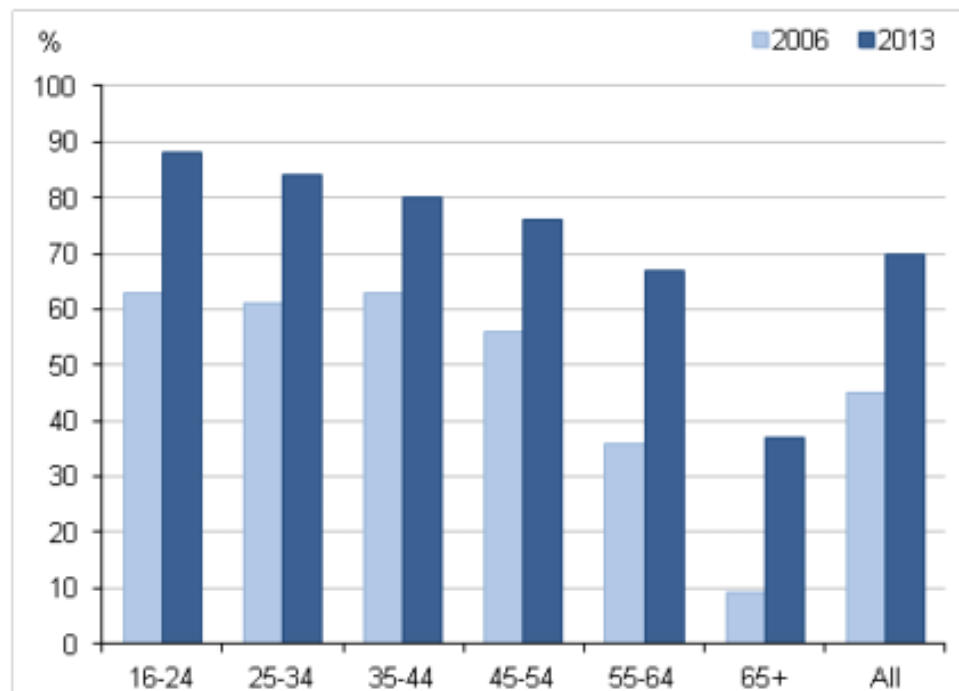


Source: (Bowen and Pistilli, 2012)

Figure 14: Student Preference for Mobile Access by Functional Category

conclusion that it may reduce or even diminish any negative influence that students have towards the readiness, adoption and usage of new mobile learning technologies.

Based on the “Internet Access - Households and Individuals” report published in 2013 by the Office for National Statistics (UK), reference is made to instructors and their relationship and attitude with technology (*Statistical Bulletin Internet Access - Households and Individuals 2013*, 2013). According to the report, although they are not considered to be the early adopters (a characteristic usually attributed to younger people), they seem to be closely following younger ages with a surprising higher increase in the use of computers in the older ages (Figure 15). Based on the forecasting on the global mobile trends, one can logically assume that the findings of this report can only be expected to increase (Clifford, 2014).

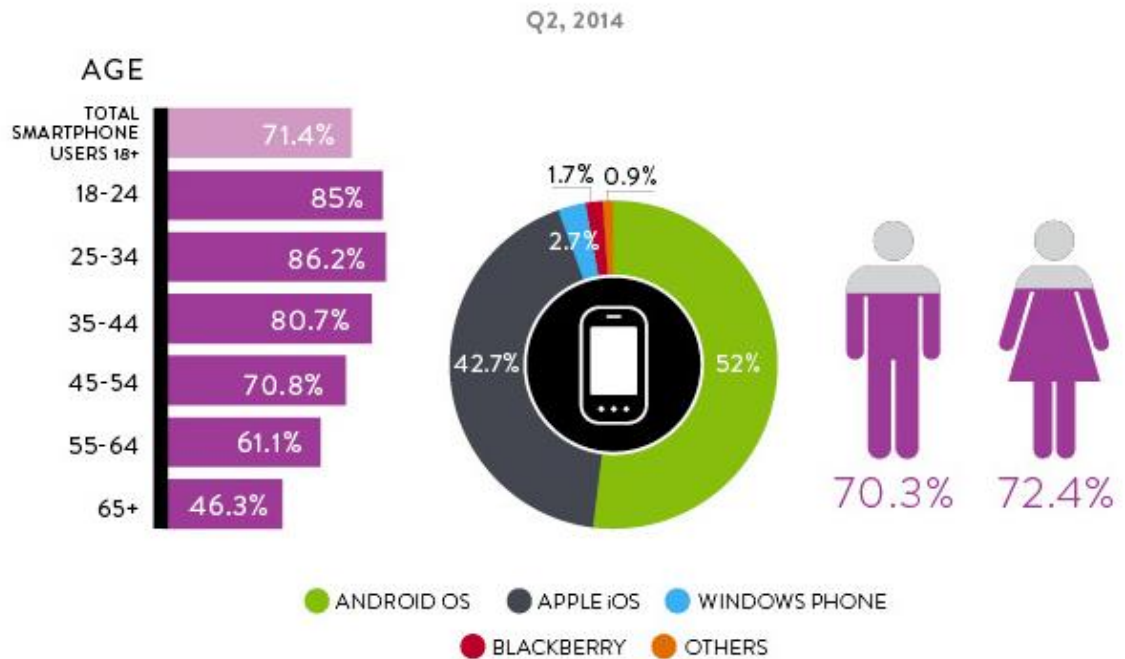


Source: (Statistical Bulletin Internet Access - Households and Individuals 2013, 2013)

Figure 15: Daily computer use by age group, 2006 and 2013

According to Nielsen (2014), the smartphone technology seems to have largely penetrated the market including the ages of even older faculty in education as indicated by Figure 16.

The evidence suggests that instructors, as an age group, have largely adopted technology and specifically mobile technologies, increasing the positive impact of Alfahad's (2012) factors towards mobile learning. As long as a new mobile technology follows the architectural logic of current, largely used, non-learning related applications, expertise should not be a barrier while the target group seems to already have accepted the benefits of this technology. This can provide fertile grounds for adopting a cross functional mobile learning application that will offer the opportunity for learners to become more active toward the use of eLearning by combining the benefits of both mobile and web-based ecosystems.



During Q2, 2014, 52% of U.S. smartphone owners used a handset that runs on the Android operating system.

Source: (*Mobile Millennials: Over 85% of Generation Y Owns Smartphones*, 2014)

Figure 16: US Smartphone Market share by age, OS and Gender

Furthermore, mLearning needs to be given credit for making learning available in distant areas for people that cannot physically attend regular courses due to geographical or work constraints or just because of other requirements (Valk, Rashid and Elder, 2010). mLearning seems to have not yet offered a technology that could possibly increase directly the effectiveness or efficiency of the technological implementation of learning theories and methods like positivism and constructivism. However, it is logical to argue that by providing ubiquitous access to current eLearning implementations, it will expose them to larger and possibly not reachable audiences, resulting to higher engagement of students. Furthermore, social options like share, like and comment may also possibly increase engagements following the same logic that made social networks and these options virally popular to people. However, the quality of learning is always subject to the provided quality of mobile service which especially in distant areas might still need significant improvement.

Finally, the latest theories about mLearning suggest pervasive mobile learning which refers to mLearning interacting with sensors thus providing a smart environment and context awareness to the learner (Vinu, Sherimon and Krishnan, 2011). Once again such technologies have been designed but not yet for learning. Such, implementations include pushing information to the mobile device user within the premises of a specific building, for example a university. User identification may be achieved once the phone is connected to the institutional WiFi. Information pushed may provide list and access to services and can be personal to the user (i.e. student/instructor services). Vinu (2011) suggests, that such technologies provide ground for delivery of education in the near future in new innovative ways.

3.4 Implementation of learning methods in Learning Management Systems

Based on the findings up to this point it seems clear that LMS are the dominant, most developed and most implemented eLearning platforms that Higher Education has invested to.

In this section of the research, the two major LMSs of the market, Blackboard and Moodle, are used to illustrate the various features available in both platforms, in an effort to perform a closer examination these platforms. It is useful to add at this point, that both Blackboard and Moodle support either the same or similar features although occasionally implemented from a slightly different perspective. However, in essence, no significant differences have been located, since both of them clearly offer tools and activities supporting the two major learning theories of positivism and constructivism and their variations. For that reason, common features will be discussed once for both platforms and will be presented within the context of the learning theory they belong to. All features listed below are

mostly viewed from the student side. Usage evidence is submitted based on the statistics tracking tool of Blackboard where possible.

3.4.1 Blackboard & Moodle features

The following table lists Blackboard and Moodle features as described by the actual application environment of both applications but also following several course instructional guides such as Blackboard Lesson Plans (Faculty Development and Instructional Design Center, 2015).

Most complex features will be furtherly described since short descriptions shown in Table 3 cannot offer a complete understanding of their operation.

3. CURRENT STATE OF ELEARNING APPLICATIONS IN HIGHER EDUCATION

Table 3: Blackboard & Moodle features

Tool Name		Learning Method ¹	Short Description
Blackboard	Moodle		
Notifications Dashboard	Notifications Module	Positivism	Used as a scheduler and project management tool to assist students and instructors keep track with the various events related to their course calendar.
Announcements	Announcements Module	Positivism	Displays course announcements the may optionally be sent to students by mail as well.
Contacts	-	-	Mostly used to disseminate information concerning faculty.
Glossary	Glossary	Positivism	used to create an alphabetic glossary of terms referenced in the course
Send Email	Email	-	Used to send email in various groups of users or specific members enrolled in courses.
Tasks	-	-	Used to post tasks, such as assignments, whose process is monitored until a certain deadline is reached.
Turnitin Assignments	-	-	The tool “forces” assignments to be submitted to Blackboard through turnitin.com so that the originality of the assignment is checked in order to achieve plagiarism prevention.
Assignments	On-Line Text Assignments	-	Submitted assignments are digitally time stamped and displayed at the grade center area of Blackboard.
Web Link	Text Page/Web Page/Link	Positivism	Content tools that facilitate instructors to include within a course site, web links, an Image, Audio, or Video. Moodle corresponding tools do mostly the same in a different way.
Image	Text Page/Web Page/Link	Positivism	
Audio	Text Page/Web Page/Link	Positivism	
Video Tools	Text Page/Web Page/Link	Positivism	
Learning Module	-	Positivism	Provides access to a structured collection of materials (content items such as those created by all the above referenced tools) referring to a specific subject that may or may not require students to navigate sequentially.
Lesson Plan	Lesson	Positivism	A Lesson Plan is a versatile Blackboard container, useful to place and organize course related items in a similar manner as an outline (Faculty Development and Instructional Design Center, 2015).
Grade Center	-	-	A tool that enables instructors to provide students with a personalized view of their grades.
Tests	Quiz	Constructivism	This tool is used to create a variety of tests. (Due to the variety of options and feedback possibilities, this tool will be further discussed in the following paragraphs)
Self & Peer Assessment	Embedded in various activities	Constructivism	Permits students to submit an assignment that is visible and available to be graded by other students in class as part of their assessment.
Blog	Blogs	Constructivism	Allows the students to publicly (within a course module) contribute course related content that may be accessed and commented by their instructor or peers on a calendar pace defined by the instructor.
Journal	Blogs	Constructivism	Allows the students to privately contribute course related content that may be accessed and commented by their instructor only on a calendar pace defined by the instructor.
Virtual Classroom	-	Constructivism	Virtual Classroom permits instructors to setup an on-line, real-time classroom discussion, and even on-line, real-time office hours or Q&A sessions during convenient times.
Lightweight Chat	Chat	Constructivism	Permits students to engage in a chat session with their instructors.
Discussion Board	Forum	Constructivism	Permits instructors to create a basic Forum for their classes.
Pools	Choice	Constructivism	An easy and fast way to post any type of questions to students.
-	Label	Positivism	A tool that permits instructors to display rich text (HTML) in their courses.
-	Directory	Positivism	A tool that permits instructors to display a whole directory structure (subdirectories and included files) for students to access and view its files.
-	Database	Constructivism	A powerful tool that permits instructors to build a database about any subject and allows updates and feedback by their students.

¹ Classifications are based on Blackboard and Moodle application environment where available.

Tests/Quiz

This tool is used to create a variety of tests. It provides a powerful time-saving benefit for instructors especially in the case of quantitative assessments like multiple choices, multiple answers, true/false, etc. The Tests tool, if properly set, provides immediate feedback for all types of tests (even in the case of essays, a sample text that can be considered as a correct and complete answer to the question), while in the case of quantitative questions like multiple choice it may provide feedback not only for correct but also for incorrect responses (one feedback for all incorrect responses). While feedback for multiple choice/answer or true/false questions is simple to understand, for essay questions feedback may not seem to be so obvious. The truth is that essays cannot be automatically corrected and there is no artificial intelligence incorporated in such platforms yet. Therefore, feedback provided cannot be specific to particular errors or omissions of the submitted essay. For essay questions feedback, may possibly be a redirection to a resource containing the expected answer or a sample answer. Following the logic that has been discussed in section 2.1.5 Figure 2, feedback may be provided in one step (providing a correct sample answer) or multiple progressive steps (leading the student to several resources) before a final answer is provided, thus implementing a constructivist approach in guiding the student through a process of constructing knowledge.

For the last two years, taking into account the adoption of the Open University assessment methodology¹⁴ at Deree-The American College of Greece, this tool has only been used for formative essay tests, which are deployed to students

¹⁴ Deree – The American College of Greece is validated by the Open University (OU), UK. Based on OU requirements formative assessments (they are not included in the actual evaluation of the student in the course) are required as a preparatory method before students are officially evaluated through summative assessments.

with the option to take them online within a period of several days. Once a test is deployed, students may be required to complete it in one continuous session or stop and resume it later on, always within a certain total amount of time. In our case, tests are required to be completed during one continuous session. Observing the usage of this tool the following benefits and drawbacks have been identified:

Benefits

- Students taking the test online may decide the most convenient time to initiate the process.
- Students take the test in a stress-free environment of their choice.
- The test is not limited within the boundaries of the class hour if this is considered necessary.
- The class hour that would normally be spent to deploy the test in-class may be invested to another, perhaps more valuable, activity. However, in most cases, it serves as a relief to the already very tight schedule of lectures, by freeing an extra class hour.
- Students may use notes or their textbook during the process. Since many students take the test without having studied before, just because it was required by their instructor, they use their notes or textbook. Although initially this seemed to be a drawback, eventually it may be considered as a benefit, since at least they do go once through the material at an earlier time before the actual exam. Consequently, they do get an idea about the volume of study that will be required during their finals, which motivates many of them to start reviewing for their exams at an earlier time compared to what they had originally planned at the beginning. On the other hand,

the few mature students who understand that a formative test serves as a milestone to early evaluate the quality of their study and resolve any issues on time, are not tempted to use their notes or textbook. Others, that may have studied, but face difficulties in answering a certain question, may use their notes or textbook so that they are not embarrassed by submitting wrong answers. Still, they do have an insight of their weaknesses. Nevertheless, their instructor does not know, and thus cannot assist or provide guidance where it might be required. That may be a downside of this implementation.

- Classroom discussion is initiated after the test is conducted in order to resolve issues that have occurred and answer questions that students may have. These questions are frequently related to comments posted with their answers during correction. Such discussions are usually quite intense and productive among students who took the test, and may attract students that did not participate at the test and even motivate them for their next formative assessment.

Drawbacks

- Using this method for formative tests has dramatically decreased the number of participants compared to the in-class (traditional) ones. Unfortunately, based on class observations for the last three years, it seems that most of the undergraduate students are not mature enough to understand the benefits of the formative test even though their studies are, in the vast majority, financed by their families and failing a course or having a low GPA¹⁵ may incur a high additional tuition cost. Mature students that

¹⁵ GPA: Grade Point average

have a high participation to these tests are usually those that are self-financed or sponsored. Currently mature students are a minority, although an increase to their numbers has been observed during the last few years.

From the above investigation, it is obvious that the test option has substantial advantages if implemented properly without abiding to policy and administrative constraints. However, since the tool was initially used for in-class formative testing, it has resulted to little or no benefits for the majority of the population due to shortage of engagement by students.

Polls

Polls represent an easy and fast way to post any type of questions to students. For example, students may be asked to choose among three alternative research areas for a paper within a certain deadline or even three alternative courses of action on a case. Students vote on the option of their choice and feedback is generated immediately indicating the overall class preference in an numeric and graphical form (i.e. pie charts). Then the instructor may use the voting outcome to initiate a discussion in class based on their choices. Additionally, polls may be used like clickers if all students have access to a computer or a mobile version of the eLearning platform.

3.5 Conclusion

Web-based eLearning platforms (mostly LMS) are well established in Higher Education. The reasons are to be found in a combination of potential financial benefits and the unique service they provide in facilitating learning. However, there are strong evidences that these platforms mostly fail to actively be involved in the process of knowledge discovery although they provide the required technology for developing constructive activities. As already discussed, the

causes are to be found in the limitations of technical expertise of instructors, in time limitations, administrative scheduling limitations and difficulties in communicating and responding to activity updates promptly. In addition to that, the immobile nature of accessing web-based learning platforms usually using a PC and the Internet has limited ubiquity and availability of web-based eLearning to the time that learners spend at home, at work or campus (Motiwalla, 2007). The undertaken exploration of the major two platforms Moodle and Blackboard, is in alignment with presented findings in literature. Additionally, it verifies the assumption that there is no obvious area for technological improvement within these applications that may directly or indirectly lead to any important increase in the engagement of its users. At the same time, the requirements for eLearning instructional design expertise is evident since, both Blackboard and Moodle, provide the building blocks but no or minimal guidance as to how they should be used effectively.

Furthermore, although students seem to have adequate knowledge to use eLearning technologies and at the same time technology growth amongst them strongly indicates that it has become part of their daily culture, they do not seem to receive the expected benefits that eLearning seems to be offering. Obviously, part of the reasons may be due to limited eLearning implementations which relates to instructors but also institutional policy but there may be other reasons that may act as disablers of the provided activities. Such reasons are considered important to be investigated by the surveys at the following chapters.

Other technologies such as Social Networks and Mobile Devices have attracted the attention of educators because of their high adoption by the market. Although studies and experiments have been performed with positive results with respect

to the use of such technologies in education, no organized methodology or technology has been produced that actively facilitates or assists constructive eLearning.

Virtual Worlds also seem to be a very promising technology for the near future and that includes eLearning. However, several technical improvements are required before such technologies can massively be adopted.

As a conclusion, it seems that the majority of higher education institutions have considerably invested in web-based eLearning platforms. Additionally, many other free or inexpensive information technologies have been found to offer certain benefits to education. However, the expected engagement primarily to constructive eLearning has not been reached both by instructors and consequently by students. As a consequence, it would be quite innovative but also cost effective to build an additional new technology that will utilize and complement the benefits and infrastructure of currently installed platforms and other available technologies in a way that will bypass the limitations leading to the current poor engagement of learners. Considering all, a new eLearning technology that will be able to combine and utilize the benefits of several already existing technologies is worthy to be examined as part of the solution.

4. Surveying Students & Instructors on eLearning Implemented Tools

Having examined not only learning models and theories but also eLearning methods and technologies, the aim of this chapter is to examine actual eLearning implementations to understand to which extent theory is manifested in practice. The goal is to identify possible implementation gaps where a new technological component could fit in to reduce their effect.

4.1 Introduction

It is logical to assume that just using LMSs as knowledge repositories may enhance the delivery of course related materials, but utilising LMSs as a knowledge repository and also by implementing constructivist eLearning components does not necessarily lead to adding value to the productivity of achieving the learning outcomes. Changing the medium of delivery of learning material has many benefits (cost, accessibility, availability, distance learning, etc.) but the content is still the same and thus equally contributing to learning as with its original form (for example on-line video and a video tape). As discussed in the previous chapters, since the design of traditional delivery approaches such as lectures, new learning models have been developed claiming to add value to the traditional educational approaches. These learning models have recently started to be implemented in the classrooms of higher education institutions. Their core characteristic is to make the student more actively engaged in the creation of knowledge rather than being its passive recipient (Jonassen, 1994), as with many traditional lectures that frequently don't turn to discussions. Srimathi and Srivatsa (2009) argue that in some cases eLearning course materials made available through LMS refer to simple PDFs or Hypertext documents. These methods enhanced by technological accessibility

may be sufficient for some students. As Reeve and Tseng (2011) state, students are different in the way they react towards learning since some students enjoy learning more than others, and are more focused, hardworking and organized. Thus, it could be logically deducted that blending a variety of methods for learning would possibly attract or affect a larger number of students by also approaching those, not so mature or focused, to some or fewer learning activities. Following the new educational trends with respect to learning models, web based LMSs such as Blackboard have started to offer features that are in line with the modern learning requirements. However, these features are not so obvious for inclusion by instructors since they require more expertise and effort both in terms of the technological and pedagogical aspects. Hence, modern eLearning platforms do offer the technological foundations to build content and activities that may offer more than just an improved repository of accessible knowledge. As Dias and Diniz (2012) state that “*in Higher Education, technology may be either used to re-enforce the prevailing practices, such as lectures, or it may be used to transform and disrupt those practices*”. Simply though, since the investment was made for a tool that has more potential than the minimum required, it is logical to expect that the additional features will be used to at least add value to that investment.

Recently, instructional designers, who are considered to be techno-pedagogical experts of eLearning platforms, are increasingly used by higher education institutions (Kanuka, 2006), although the instructors are still the content experts. Instructional designers guide them on how to structure an on-line or blended course by best utilizing current eLearning technologies and their most appropriate features with respect to the content provided. However, this merging of expertise is quite recent and thus not widely available. At Deree College, which mostly

provided the target population surveyed for this thesis, except for courses build for this research, instructional designer services were made available just last year and there are a couple of new blended courses that will be introduced to students at the fall of 2017.

In the following surveys, both student and instructor perspectives towards LMS implemented modules in a university environment are investigated to identify particular weaknesses in implementing both traditional and contemporary LMS methods. Additionally, the validity of the assumption that a variety of learning methods may lead to more engaged students is examined. The aim was to identify areas of technological improvement of eLearning by providing additional services in a way that reduces the drawbacks of current implementations and enforces the productivity of learning theories. Additionally, the goal is to assist higher education institutions in taking corrective actions towards the appropriate use and development not only of LMS content but also activities that exploit a rich variety of eLearning methods currently available. This may additionally assist in the development of more appropriate learning strategy that may enable more students to reach the expected learning outcomes as set by the module's syllabi.

4.2 Learning Management Systems in Higher Education: A Student Perspective

Undoubtedly, eLearning will play a significant role in education. It offers a wide range of unique benefits and seems attractive financially. At the same time, globalization and technological improvements have already set the grounds for a virtual society to form. It seems that the question is not whether institutions should adopt it, but how and with what cost, in order to make it productive and successful.

The goal of the survey is to understand how faculty and students adopt, perceive and use implemented features of eLearning through the perspective of students at this stage. The general research question that needs to be examined is if the variety of learning methods currently supported by eLearning web-based applications already addressed at the previous chapters are made available to students and to what extent. Additionally, if those online contents and activities are implemented in an effective way. Finally, to study the access, use and participation of students in such implementations.

The use of web-based surveys was considered more suitable than other data collection methods (e.g. interviews, focus groups) for the following reasons:

- The data needed to be collected were not already available and could be obtained using other data sources or collection methods. Although some data could have been obtained from the university's student information system, they would have not been successfully correlated with usage data from the LMS.
- Surveys provide a fast and effective way of gathering data from large populations (Bachmann, Elfrink and Vazzana, 1996) which was found very suitable in this case due to time constraints already referenced in section 1.3.
- Surveys can provide widely acceptable behavioral results through the analysis and cross tabulation from multiple answers (Sukamolson, 2007) (e.g. correlate student maturity data with eLearning activity usage).
- Theories and statistical hypotheses can be more easily tested using quantitative data while web-based surveys are simple and more

convenient for participants thus permitting to address a bigger sample in less time (Wright, 2006).

- Online surveys have a very small cost to be implemented which was also important because of the budgetary limitations of this project (Wright, 2006).

4.2.1 Methodology

This survey studies which areas, features and tools of an LMS students use more. Additionally, what is level of student satisfaction towards LMS. Finally, it examines the students' point of view towards LMS and how they are used by their instructors. The goal is to identify what areas of LMS are implemented and based on the students' perspective, detect weaknesses in either LMS applications or the use of LMS by faculty.

The survey was based on a sample size of 152 respondents who have registered in various undergraduate courses at Deree College. Invitations were sent via email while most respondents reacted to a face-to-face promotion by instructors which dedicated sometime at the end of their class periods for students to address the questionnaire. Face-to face promotion was used to compensate for the very low productivity of email invitations. Email seems not to be considered a productive tool to invite people to participate in surveys (Jaime *et al.*, 2013).

Students were enrolled from various programmes of Deree College thus making this sample a representative of students from various college levels and disciplines. Furthermore, approximately 3000 students from more than 50 countries are currently studying at Deree enforcing the survey sample with the additional benefit to measure the opinions of multinational and multicultural students. Because of the multinational variety of the participating sample, it can

be generalized that the observations are not indicative of one country or culture. Deree College is a non-profit, English speaking higher education institution in Greece that offers baccalaureate and graduate degrees in the liberal arts and in business administration accredited by the New England Association of Schools and Colleges, USA and validated to offer Honours awards by the Open University, UK. Consequently, Deree is a multinational hybrid educational institution that attempts to combine the advantages of both American and UK educational systems thus providing a rich survey ecosystem to compensate for deploying the survey only at this place.

This method (online web surveys) was chosen as the most appropriate for implementing a deductive methodology that is intended to provide indicative but representative evidence towards the implementation and use of current eLearning platforms. The purpose is to identify gaps between theory and implementation that may be used as an opportunity to build a new technology that may increase the effectiveness and efficiency of eLearning apps by resolving the indicated weaknesses.

Additionally, as already discussed, there are several advantages for online surveys, some of which were critical for this research. Online surveys may be considered faster, cheaper, and more accurate compared to other methods that include data-entry. At the same time, they are quick to analyse, easy to use for both participants and researchers, more honest compared to telephone or face-to-face surveys and more flexible as they may be partially edited even after their implementation without affecting the collected data (SmartSurvey, 2016). Finally, they may also incorporate computer logic that permits decision-tree structured surveys (FluidSurveys Team, 2013).

The most critical factors for these surveys were time and cost. The major time constraints were the following:

- The surveys could only be deployed during two specific academic periods within the nine months of the academic year where students and instructors are available on campus.
- The deadlines imposed by Plymouth University and Deree College.
- No budget was allocated to this research apart of enrolment fees except of financial assistance to publish the three papers related to the thesis. All other costs (domain names, webhosting, development tools, printing, courier services, etc.) were made at personal expense.

All surveys were approved by the Plymouth University Human Ethics Committee and the Dean of the School of Business Administration of Deree College and the Deree Internal Review Board (IRB).

The survey was delivered to students from a variety of different courses and course levels in an effort to also examine any possible correlations between the maturity of the students and the usage of the technologies under examination. The purpose was to capture their opinion as their academic life evolves in different fields of study.

The survey was made available through a web-based questionnaire (see Appendix III) divided in sections corresponding to the ones presenting the results in the following part of the chapter. The survey was deployed through a private website using the LimeSurvey Open Source online survey tool, which was installed for the purpose to be used for these surveys. Besides the fact that LimeSurvey is considered the leading Open Source software in its category (*LimeSurvey - THE Online Survey Tool*, 2017) and as Open Source is free to use,

it is also not only easy to install and deploy but at the same time a powerful tool with all the features found in the commercial equivalent tools. LimeSurvey's benefits, especially with respect to cost and fast implementation, made it the most logical choice for these projects.

The survey was anonymous and therefore, no identification data were requested by the recipients nor any digital data that could possibly be used to identify participants were monitored, made available or stored.

The question types, of the survey, were quantitative, and included multiple choice/answer, matrix and true/false questions. The nature of the research questions combined with the benefits of online surveys permitted to get a strong indication of current implementation perspectives that would reveal implementation gaps and weaknesses of web-based eLearning applications pursued by this research. Introducing qualitative methods may have offered more and possibly more detailed insight which however would not have been determinant for the outcome of the research. Considering that time available for approvals, survey design, data analysis and conclusions was very limited, a qualitative approach seemed not to offer significant advantage to be used extensively at this stage.

In all questions required, additional help text was added to clarify the question type or content.

Considering all, the samples may be considered as representative since they derive out of a multinational, multicultural population of students from a variety of ages, modules and disciplines while the respondents size (especially that of instructors) is representative of the total population of the surveyed ecosystem of Deree College.

4.2.2 Demographic Data

Demographic data were collected for two reasons. Firstly, to confirm a sample that would include a variety of participants with respect to variables like age, gender, module level, discipline, etc. That was an additional reason for the selection of the LimeSurvey tool, since it provides single variable analysis while the survey is still active. Secondly, to collect demographic data that may be used for correlations with other variables such as usage of LMS. For example, are older students, an indicator of maturity, more engaged to eLearning content and activities compared to younger ones?

Within the general context of deductive methodology followed by this research, several variable data were collected to examine as many possible areas and correlations of the institutional eLearning implementation. Those mostly relevant to the research path eventually followed in this thesis are presented here.

55% of the total population of surveyed students are male (68 students) and 45% are female (83 students). As the numbers indicate, the sample population was almost equally balanced thus reflecting the opinions of female and male students.

Gender seems not to indicate any influence in the perception of LMS implemented.

A graphical representation of the stated data may be found in Figure 98 (Appendix IX).

Furthermore, The largest population of students are around the age of 22 (most populated ages are: 22=17%, 21=13%, 21=14%, 20=14%, 19=11% and 18=7%).

The ages greater than 25 that represent a small amount of the population, which also seem to be the ones with the least interaction with TEL.

Distribution of Students per Pathway¹⁶

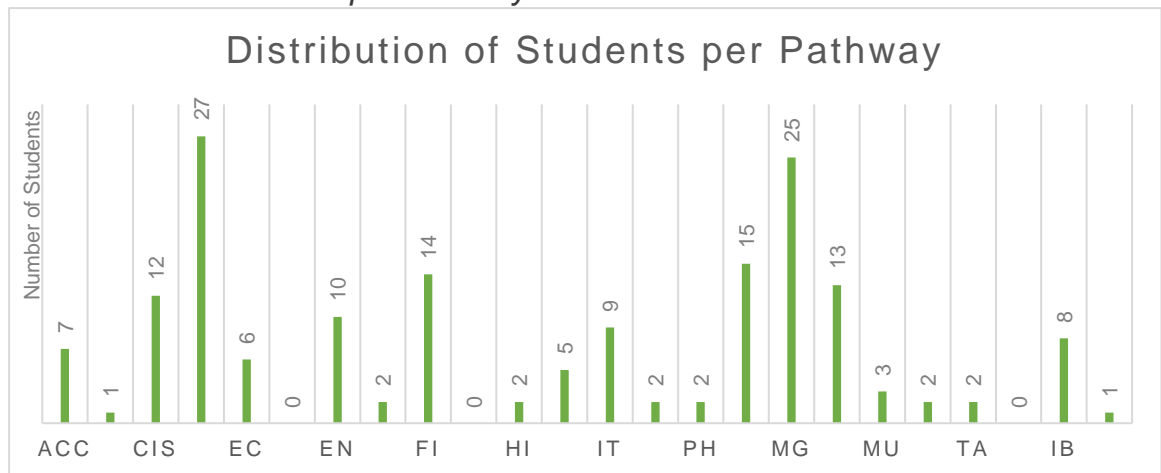


Figure 17: Distribution of Students' per Pathway

- ACC Accounting
- HIA History of Art
- CIS Computer Information Systems
- CN Communications
- EC Economics
- ENG Engineering
- EN English
- ENV Environmental Science

¹⁶ The distribution of students in the various areas of studies displayed in Figure 17 is not related to the distribution of the questionnaires but to the population of students enrolled at the various majors (pathways). Business majors at Deree-The American College of Greece are the dominating population, hence more students responded to the survey from this area.

FI	Finance
FA	Fine Arts
HI	History
HM	Hospitality Management
IT	Information Technology
LS	Liberal Studies
PH	Philosophy
PS	Psychology
MG	Management
MK	Marketing
MU	Music
SO	Sociology
TA	Theatre Arts
VA	Visual Arts
IB	International Business & European Affairs
UD	Undecided (1 st year students mostly)

Internet Access Statistics

The distribution of students depending on the place they access Internet from, is exhibited by the chart in Figure 18.

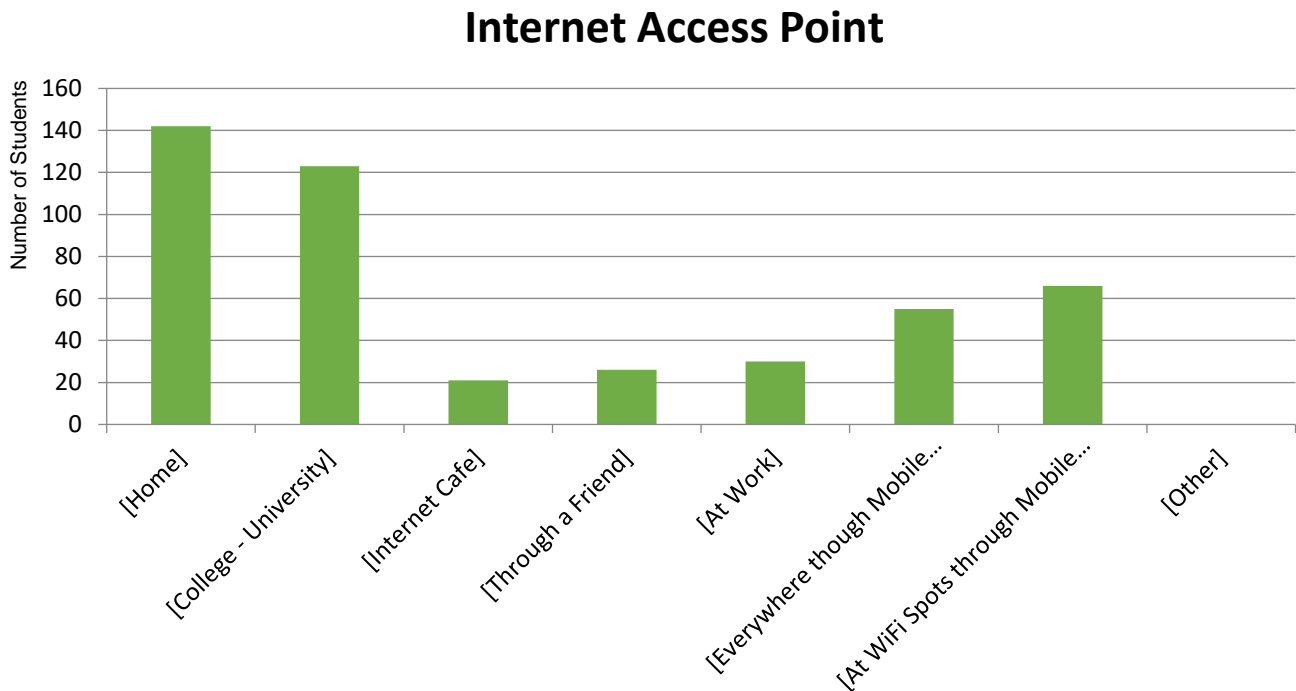


Figure 18: Internet Access (Students)

Since student access, as described by Figure 18, includes those that have access to Internet through a combination of ways. Additionally, the analysis of the data, also lead to the evidence described indicating that most students (93%) do have access from home thus proving Internet's high penetration among them (A chart describing the above finding may be found in Figure 99 - Appendix IX).

The deducted conclusion based on the analysis is that most students today do have Internet access from their home, irrelevantly to their financial status and even though private education in Greece may claim to offer more chances towards computer literacy.

Further analysis of the data reveals, (presented in Figure 19) that 77% of the total students use high-speed access Internet at home¹⁷, while a significant set of students (7%) is having mobile access only.

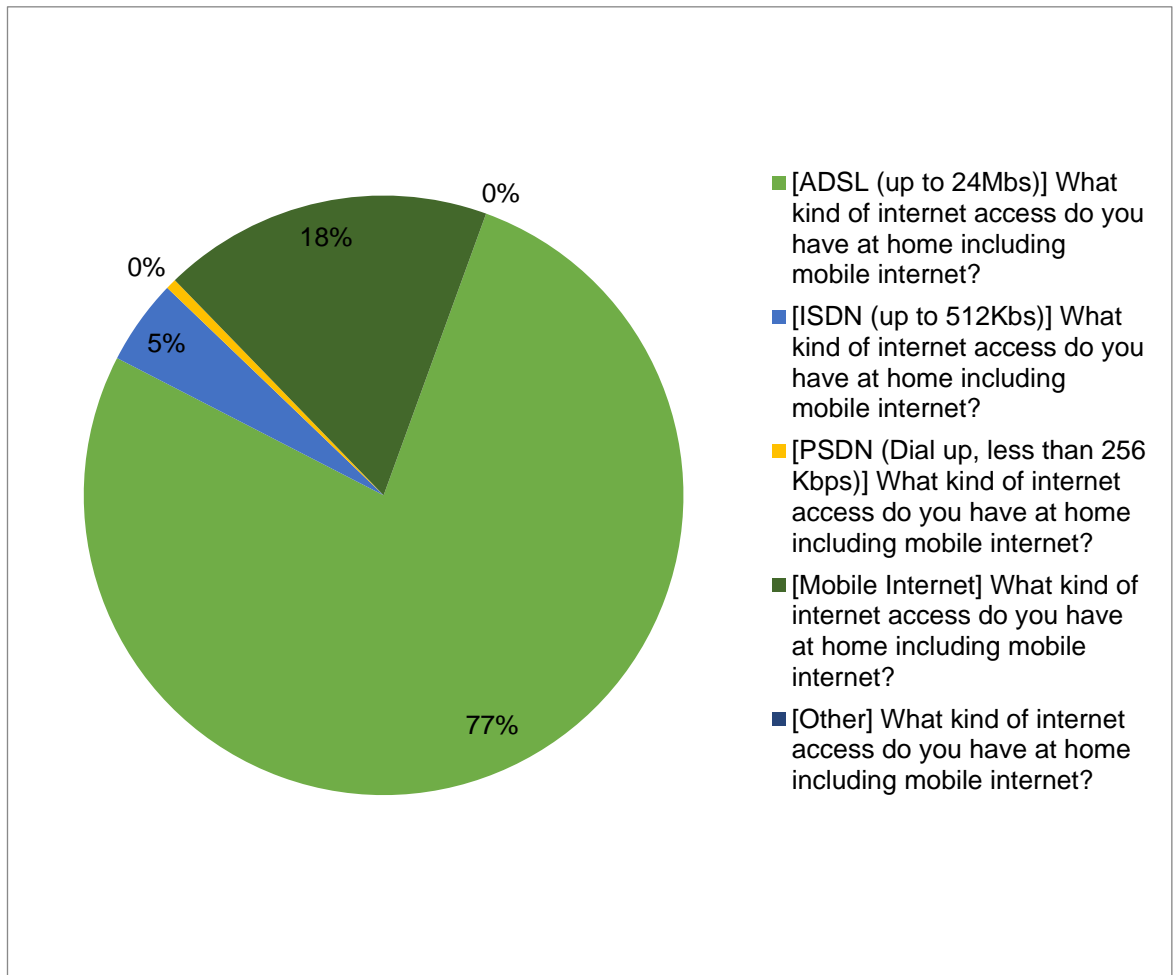


Figure 19: Internet Access Type (Students)

It seems that high-speed Internet access is an average consumer commodity; hence it is expected that the majority of students do have easy and fast Internet access at home. Furthermore, a significant number of students have mobile access enabling them to access Internet almost everywhere through hand held devices. This number has drastically increased since this survey was made as it will be discussed further on.

¹⁷ At the time that this survey was deployed VDSL was not available in most areas of Greece.

The obvious conclusion from the above observations is that technology required on behalf of the students to access and use eLearning Systems is adequate and constitutes no barrier to eLearning productivity. Furthermore, a significant number of students that have mobile access may as well raise some considerations about also investing to mobile platforms for the development of Mobile Learning (mLearning) applications.

4.2.3 eLearning Data Analysis

High-School eLearning experience

Most of the students during their high school years, have used some kind of a web site, to mostly access institutional information and frequently download material made available to them by their teachers. A 31% of the total population have experienced an LMS system, while the number of students that had no access to Internet resources through their school is insignificant (Figure 100 – Appendix IX).

So, this empowers the previous evidence concerning whether students are technically experienced to embrace eLearning Systems, since there is a large number of students that is already familiar to the web, while many of them have experienced some short of LMS.

4.2.4 LMS Content Analysis

Contents that students use

According to Figure 20, it seems that most students are using content that is mandatory for them in order to attend the course. However, considering that the following data, there is no evidence as to the context of the usage of the particular areas. The data collected does not present any frequency or repetition of use nor provides any qualitative indicators as to how the particular areas are used. However, it provides evidence that students have familiarity with the particular areas of the LMS which is a strong indicator that they have interacted enough with each particular tool. The extend of that interaction is unknown. The data also shows that there are several tools that are not even recognized by students

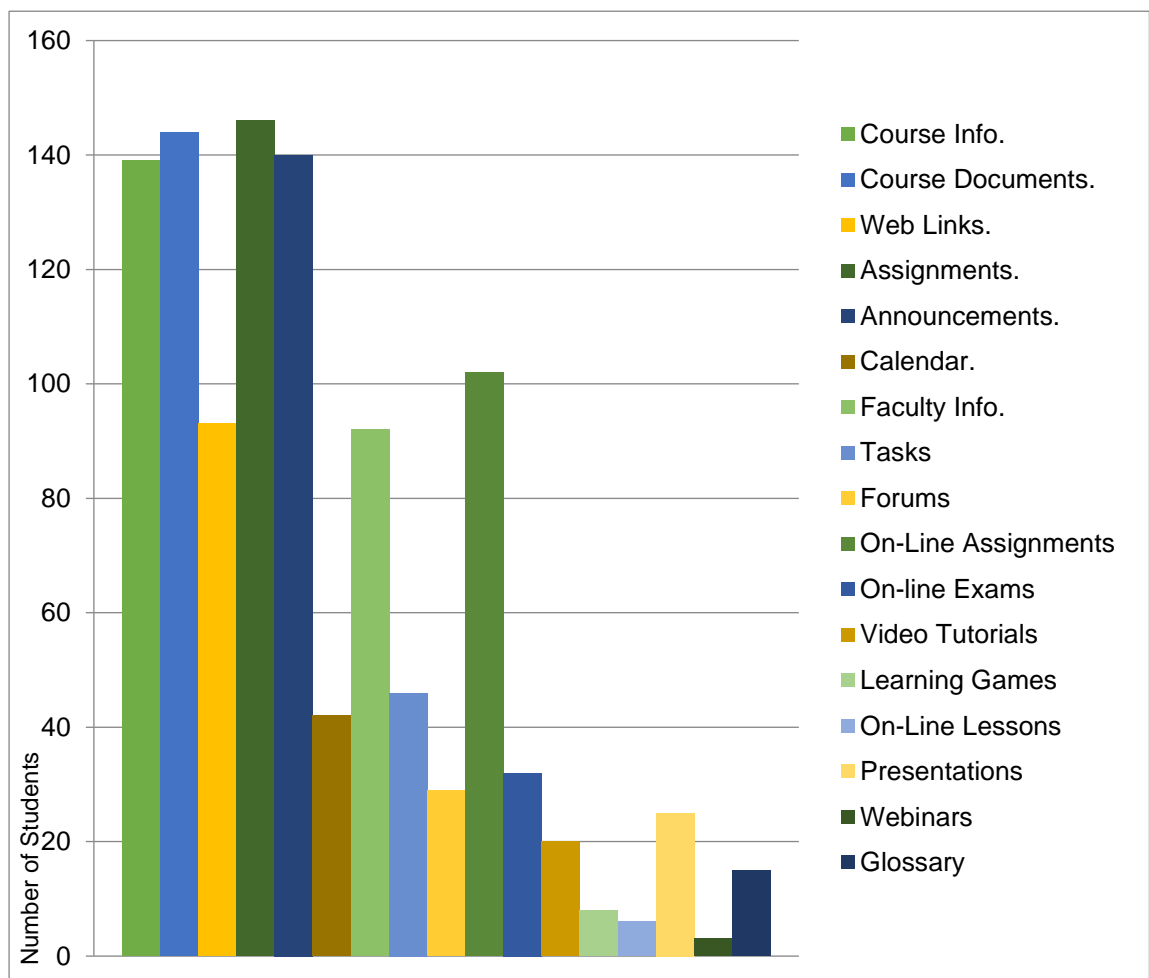


Figure 20: Which content do students use?

indicating no interaction at all. This could either mean that they have never been introduced to an activity that required the use of this tool or such an activity although somehow introduced, failed to be properly followed up for students to continue using it. Reasons leading to this implementation failures will be explored in the following sections of the research since they may be providing an insight towards improvements in the effectiveness of LMS that can possibly address the research aims.

Additionally, students were asked to provide supplementary insight as to the content of popular, informative or learning, Blackboard container areas.

Course Information (Figure 21), which is one of the most popular areas visited by students, provides documents and information that is related to the course, yet not related to actual learning.

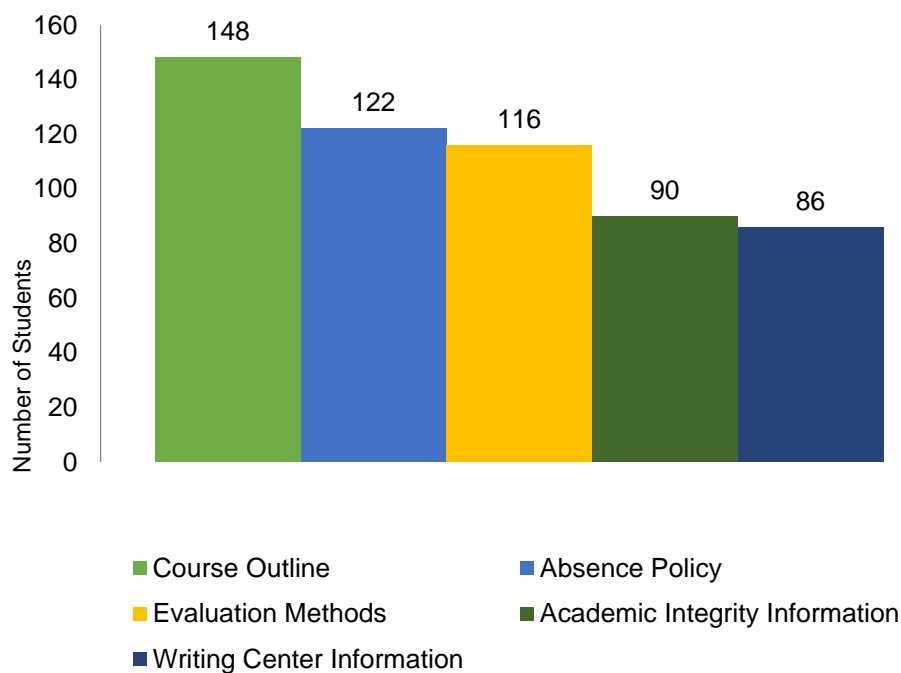


Figure 21: Course Information @ Bb

Course Outline is at the top (97%), followed by Absence Policy (80%) and Evaluation Methods (76%). These contents do attract the largest number of student visitations.

The Course Documents area, is also one of the most popular areas of LMS as depicted by Figure 22, with the top accessed areas being the Instructor's Notes (77%) followed by the Course Presentation Files (70%). This area which provides access to learning related documents is popular, yet not as popular as the Course Information area that disseminates information about the course policies and deadlines. On the other hand, Web Links posted to guide students to sources of information related to the learning content of their course (especially in business and specifically in CIS and IT courses) are far more popular (76%) compared to those leading to institutional on-line services (41%). This could be evidence that students prefer to access information related to how things actually work rather than scripts describing how things are supposed to work. For example, in the e-Commerce course, students are more willing to access a link to an actual live site area that depicts the taught concept (i.e. an eShop's check-out process), rather than accessing a link to a site or document that talks about how the concept should be implemented. Having said that, since both are required to understand the taught concepts, the question that is raised is how can students learn to equally appreciate and receive the required information?

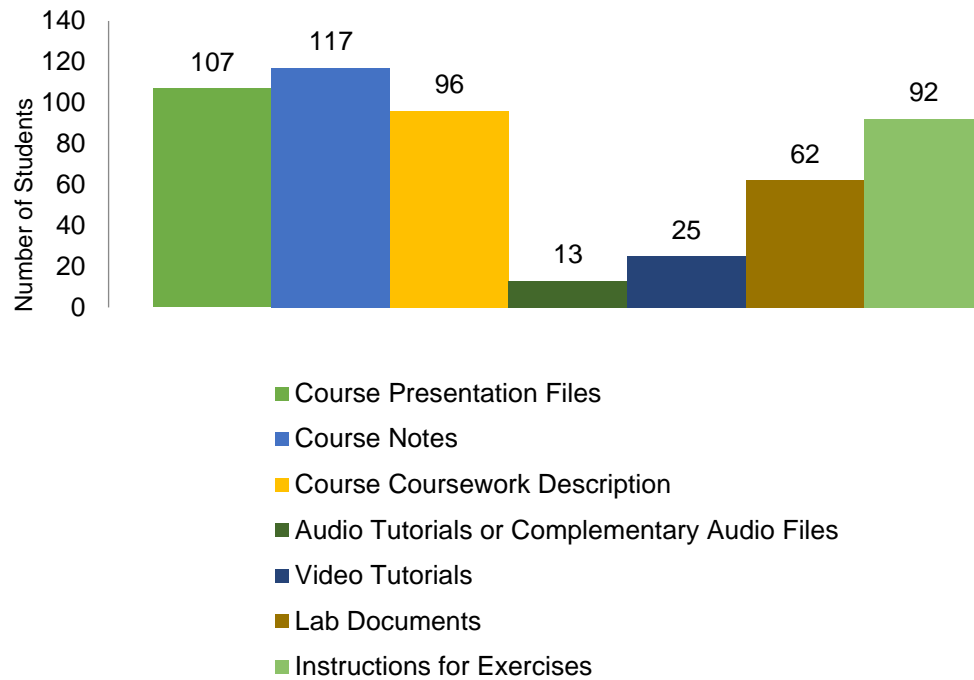


Figure 22: Course Documents @ Bb

Evidently, not so many of them use the constructivist features of the LMS. However, it remains to verify if such content is built by a large number of instructors, and made available to a notable number of students. Towards this direction, students were asked to provide information about which content instructors update most frequently.

Which content do students believe instructors update most frequently?

Towards the above stated directions, students were asked to rate some how often do they think the information disseminated to them through the LMS is updated. This involved not only LMS features commonly used, but also ones that are used rarely. The results are presented below.

From the chart in Figure 23 it can be clearly observed that the most complex (i.e. Video Tutorials), the most time consuming (Glossary) and the most frequently updated feature (Calendar & Forum) are not even implemented by most instructors or at least if they are implemented they are not promoted or used in

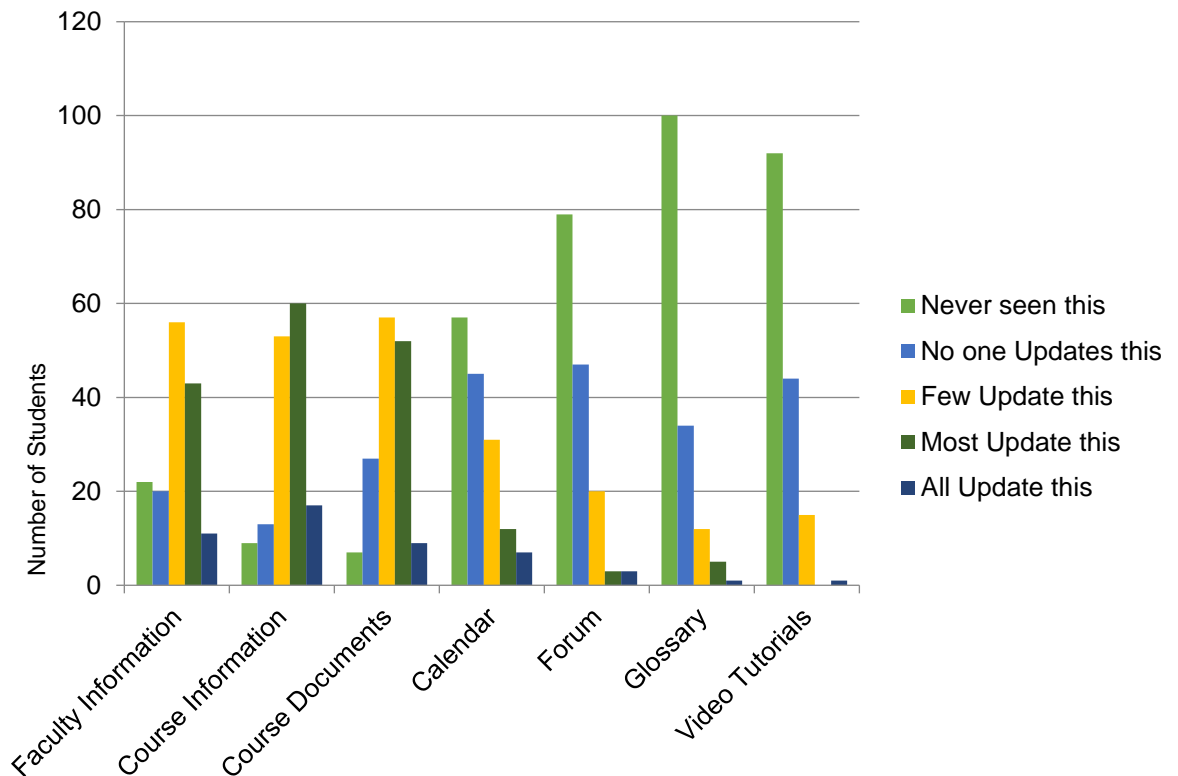


Figure 23: Students' Opinion about content areas updates

their classes. Consequently, this may be considered as a strong indicator that there is a number of students that may not know that such tools are available! Modules that are non-complex or those can be implemented faster, and do not need frequent updating, are more extensively used not only by instructors but also their students. Still, a significant number of students believe that even those, are not updated as frequently as they should.

Students' evaluation of various LMS features

Figure 24 reveals some interesting evidence about the students' perception on how helpful are various features of the LMS.

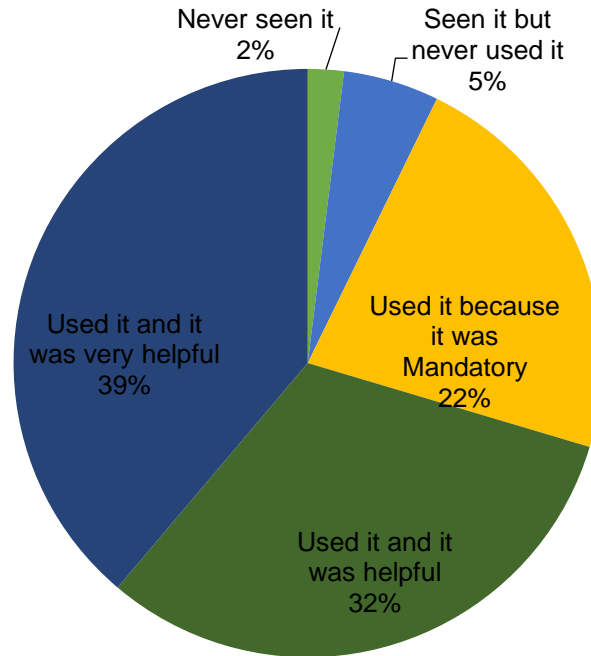


Figure 24: Assignments evaluation

Features that support information dissemination, those that are relatively easy for instructors to use and the ones that provide course task automation like setting deadline reminders are quite popular among students, while the percentage of students that are not aware of them is insignificant. Furthermore, attention needs to be given to Assignments, which are mostly related to learning rather than the operational support of the course. Such attention may provide grounds for instructor – student interaction and is highly appreciated by students. A significant 71% of the students found this feature helpful or very helpful!

Additionally, features with either a high degree of complexity, not commonly used or require a technical background, attract a higher number of students.

In Figure 25 we observe that the content management areas such as Course Information, Course Documents, Assignments, etc. are highly used by a large number of students in the sample. Combining survey student opinions with Blackboard usage data, there is a clear indication that these areas are also popular to instructors possibly because they are not demanding in terms of the technological or educational background required to implement. Additionally, most of those features are somewhat mandatory to be used by students as they may contain vital course information like submission deadlines or be part of a summative assessment.

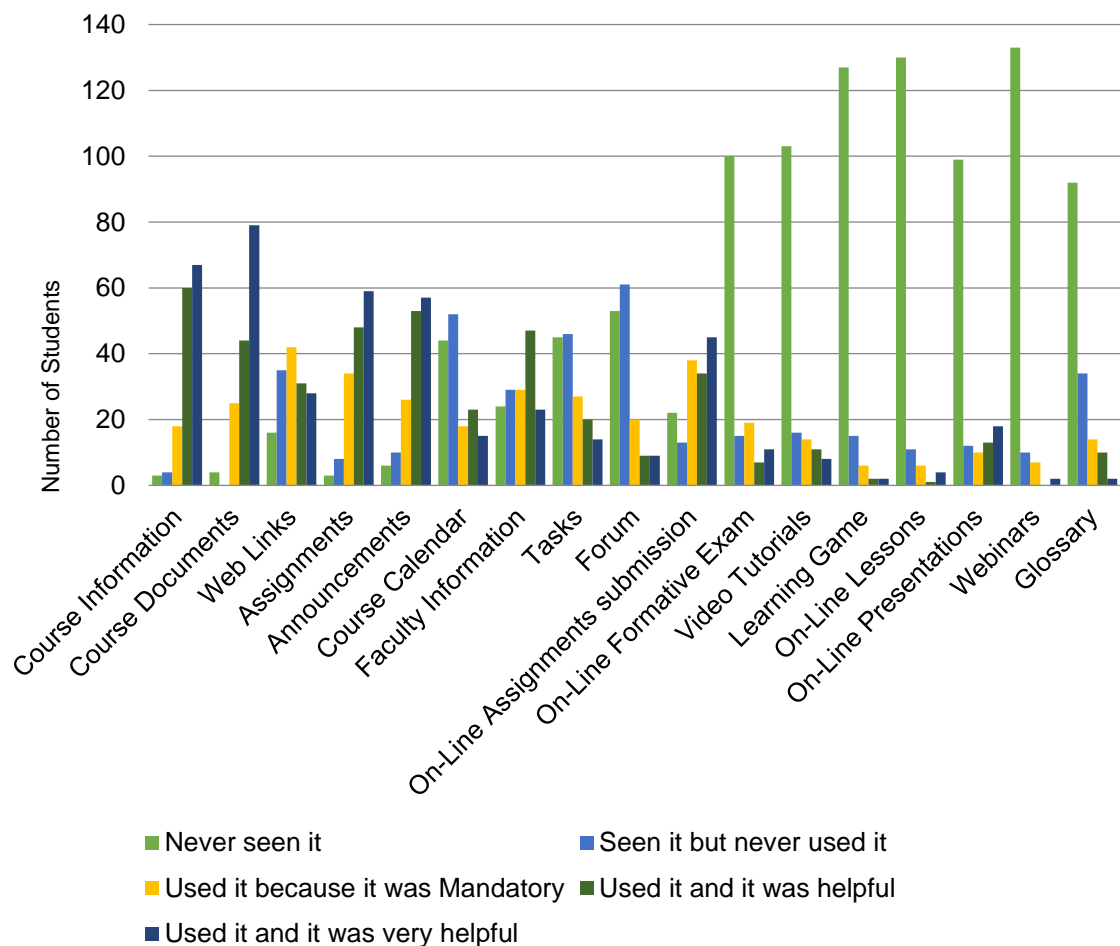


Figure 25: Students' evaluation of LMS features

Features with either a high degree of complexity, which are not commonly used or require a technical background, seem to attract a small number of students at first glance. However, when correlating these data to Blackboard Institutional data

it was found that these indicators are due to the fact that a very small number of instructors have implemented a small number of such tools. In most cases, such tools were only implemented to provide observations for this research. In the few courses that such tools were implemented there was a good indication that their popularity exceeded that of other commonly used tools. It was interesting to find that the Forum is a quite popular tool although, in most cases (according to the official module assessment methods of the institution) is not used as part of summative assessment. Although quite a complex tool (compared to all other more popular tools), based on the data, its popularity seems to be confirmed by multiple implementations of the Forum in several courses. This is an indication that confirms the productivity of interactive eLearning activities since students seem to respond to the tool without the motivation of a summative requirement that adds to the grade of the student.

Therefore, there is a strong indication of limited overall usage of complex eLearning features that could possibly lead to higher student engagement. When considering the total sample, there is also a strong indication that there is a notable number of students that are not using or are engaged with most of the available tools. This is also confirmed by Blackboard usage data. Therefore, there seems to be a gap of awareness or motivation for any interaction irrelevantly to the tool used. At the same time, while there might be an indication that more complex constructivist tools may slightly affect participation, those are the least implemented tools made available to only a small number of students. Possible reasons that may justify this indication of large absence of engagement or access of the examined tools may be the following:

1. Instructors do not have the technical expertise to use these features. After discussing this with college professors, it was found that many of them, didn't even know the functionality of features like On-Line Lessons, Webinars, Video Tutorials, Learning Games, etc. Few of them that have been acquainted with such features, they couldn't really determine how they could introduce them to their courses. In fact, for some of these tools, such as Webinars and Video tutorials, it would be unfair to expect that instructors from non-IT disciplines have the expertise to use them. If an educational institution wishes to increase the usage of such technologies, they should seek guidance from eLearning technical specialists in order to assist faculty towards that direction. Furthermore, effective usage of such tools requires additional specialized software (for example video editing applications, SCORM editors) that is not necessarily widely available by the institution.
2. Instructors do not have enough time to invest towards understanding the use of eLearning applications, or invest in the development learning modules through them. In fact, most instructors claim that they do not have the time to effectively monitor and respond to eLearning activities promptly. To develop a video-tutorial, not only specialized software is required but also a considerably large amount of time, needs to be invested ('Impact and Challenges of E-Learning', 2003). This does not imply the use of expert technology (e.g. studio recording production quality), which in term, is not necessarily required. Using youtube.com to test the popularity of tutorials developed using basic tools, it was found that such technology is sufficient to attract a quite large number of people.

So, the content is what really matters as depicted by Figure 26¹⁸. This tutorial was viewed by more than 20,000 people, not including surveyed students that have access to it through the institutional LMS. Despite the level of expertise and the availability of tools and facilities, in the discussions, followed the findings of this survey, with fellow instructors, time was their second most important challenge after insufficient expertise.

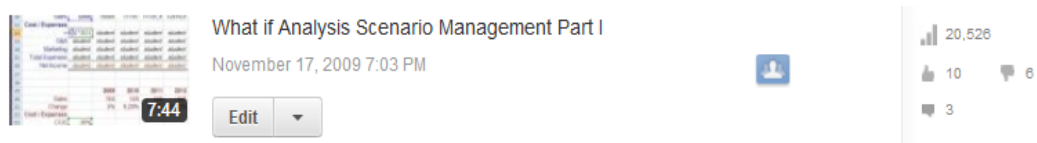


Figure 26: YouTube Statistics of a Video Tutorial created for the CIS introductory course

3. There is some kind of problem in the whole logic of the examined eLearning applications. Information Technology Services personnel of educational institutions are not that different than those found in other industries. In time, they gain experience concerning the particularities of applications used in education, but especially in small institutions, there is one IT department responsible both for educational and operational applications such as the LMS, campus student information systems, accounting, payroll, etc. In fact, it seems that most of their time is invested to the operational IT support part of their duties rather than the educational. Hence, they treat the implementation of educational solutions as merely installations of just another piece of software that was requested by the school. They know how to basically install the application, they strive to maintain it, but in most cases, they don't know why and how it is used. During this survey, several technical issues occurred by just implementing

¹⁸ Figure 26 refers to a video tutorial showing how mixed relative/absolute addresses are used in Excel. The exercise is done in class. The tutorial along with an unsolved spreadsheet and written instructions and solution is also supplied. That way students may revise the corresponding class at any time they like from any place choosing among multiple available formats (text and audio visual).

some representative features of eLearning applications that have been installed sometime in the past, but were never tested or used by anyone. Once they were put into operation, several problems were observed, some of which have not been resolved for a period of 9 months even though support tickets were opened at the level of the respective application providers! It is only logical to assume that the absence of such tools observed by students is due to this fact.

4. Concerning those, not so “popular” features of eLearning applications (which include some of the top constructivist eLearning methods), some further analysis revealed the following evidence: 38% of the total students who had access to video tutorials thought they were helpful, while 58% of the total students that had access to On-Line Presentations thought they were helpful or very helpful. The conclusion that can be drawn is that although not widely available, there is an indication that eLearning features with a high degree of constructivism, are gaining appreciation by students. However, the survey results do not signify a trend since most eLearning constructivist features were never made available to the surveyed students. For example, 66% of the students have never been asked to use an On-Line Formative Midterm Exam, 84% have never been presented with any Learning Game, and for 85% of them, an On-Line Lesson was never made available. Finally, 87% have never been offered the chance to attend an interactive webinar.

The institution invested on TEL implementations which have been installed by the IT department without the involvement of education experts like eLearning instructional designers. Consequently, several problems are bound to appear.

It is impressive to realize that 35% of the total surveyed students have never seen any TEL application in operation (Figure 27).

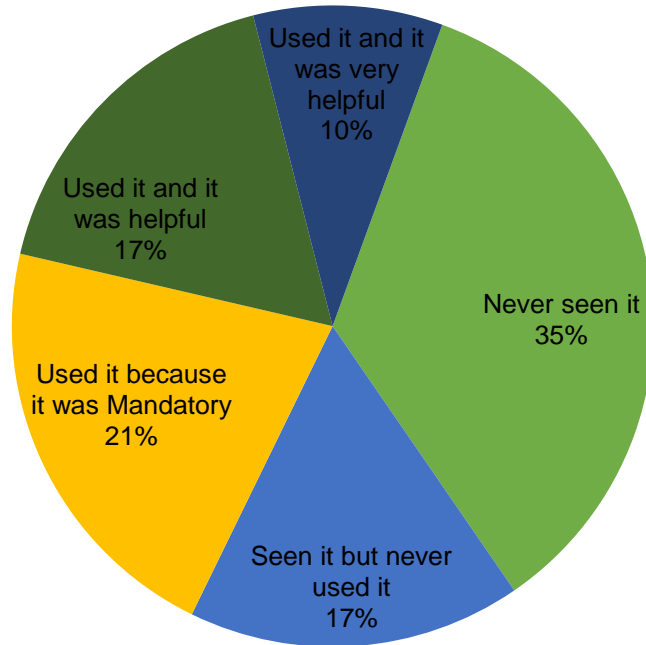


Figure 27: Average of students' observation about which area (major) mostly uses TEL applications

As also observed earlier in this section, students' usage of eLearning content and activities is not as high as it would be expected despite the benefits of such implementations, including for the most popular tools and those related to mandatory access based on the course requirements.

Data collected during the survey and presented in Figure 27, was compared with data related to student disciplines, as shown in Figure 28. The reason was to examine if student engagement is related to these disciplines.

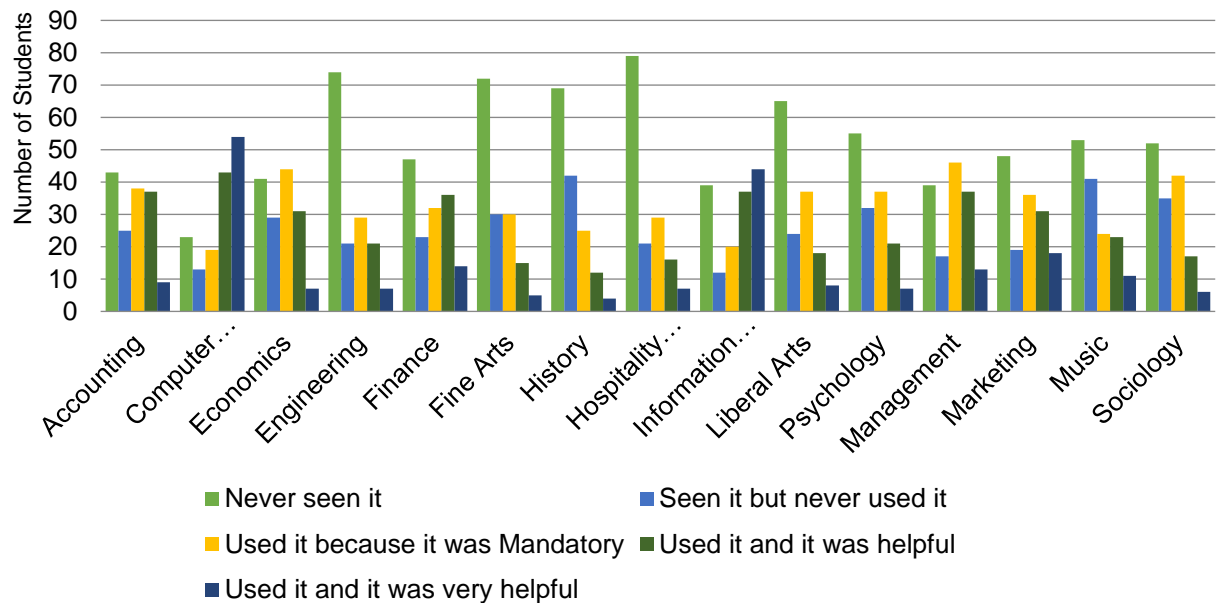
Students' observations about which Academic area mostly uses TEL applications

Figure 28: Students' observations about which Academic area mostly uses TEL applications

The data presented in Figure 28 were used to formulate the following assumptions as possible reasons of the poor participation of students in eLearning implementations:

1. Students do not have sufficient technical expertise to use such tools. More specifically:
 - a. The Computer Information Systems (CIS) major (Figure 28) have the smallest percentage of students that have never seen any implementation of TEL applications while both Computer Information Systems (CIS) and Information Technology (IT) have the highest level of appreciation for those applications compared to business students.
 - b. Business students have a high number of students not exposed to TEL applications.
 - c. Arts and Humanities students seem to have the highest numbers of not informed students (Figure 28).

The following may be the reason behind these data. CIS and IT instructors and also students majoring in these areas are both more technically competent to develop and use such applications. Business instructors and their students are more technically “aware” compared to the corresponding group in the Arts and Humanities areas. Although a well-designed eLearning implementation may require minimal technical skills from students, the technical background required might still be not adequate for several students (‘Impact and Challenges of E-Learning’, 2003).

2. TEL applications were not promoted appropriately. Just an email announcement of the availability of these resources will reach a very small group of students and an even smaller group will respond to it. Student mailboxes are bombarded by a huge number of attractive abstractors such as advertisement or notifications from social networks and games on a daily basis. Furthermore, there is always the danger that some of the email send, end up to the spam folder of the recipient email service only to be possibly discovered when they are outdated (NACM, 2014). On the other hand, mass mail send to many recipients seems to be ignored by recipients who prefer to open emails send to them personally (Maslowska, Putte and Smit, 2011). Therefore, automated email announcements and other type of mass mail communication on eLearning new activities or updates are mostly expected to be ignored. Furthermore, in order to increase the effectiveness of emails the content sent needs to be rich not only in terms of information but also in terms of presentation (images, links and typography) (DeKay, 2010). Not only such emails are not generated by eLearning automated updates but also require additional technical

expertise and time on behalf of instructors. Hence even important email announcements are frequently lost among the bulk of the total mail messages or ignored. Comparing Blackboard usage data between activities that were announced using email and others not announced at all, almost no difference was observed in the reaction of students with respect to accessing the content. Email seemed to almost have no communication effect! To further investigate this, an email was sent to students announcing a formative exam. However, the exam was not made available at the indicated LMS container. Out of the 32 students receiving this email only one contacted the instructor to inform that the exam was not available thus enforcing the assumption that email messages generated by the LMS do not succeed in their purpose.

3. A clear institutional strategy for eLearning might not be present. Especially in the case of Greece, eLearning is a new, yet unexplored area. Very few institutions have a central eLearning Strategy empowered and supported with people from IT, educational technologists, and faculty members to design, train and develop eLearning applications.

Evaluation of the content use of TEL in various modules

In order to make a closer observation on the use of TEL, students were asked to evaluate the use of these applications throughout several courses in terms of how rich¹⁹ their content is. Those courses were picked among several areas and levels. The chart in Figure 29 shows a general perspective of these findings.

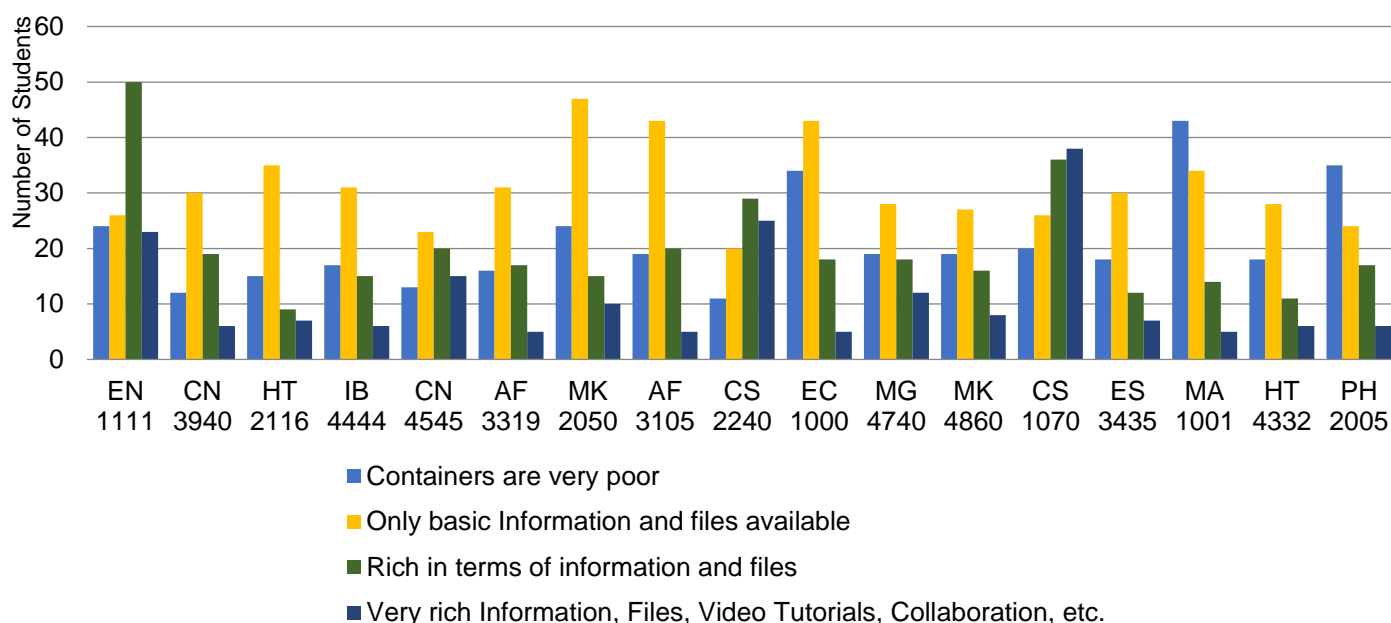


Figure 29: Course related observations of students

EN 1111	Academic Writing, Level 4
CN 3940	Communication Seminar, Level 5
HT 2116	Hospitality Information Systems, Level 4
IB 4444	International Management, Level 6
CN 4545	Advanced Media Production, Level 6
AF 3319	International Financial Management, Level 5
MK 2050	Principles of Marketing, Level 4
AF 3105	Principles of Finance, Level 5
CS 2240	Electronic Commerce, Level 5
EC 1000	Principles of Microeconomics, Level 4
MG 4740	Business Strategy, Level 6
MK 4860	Marketing Topics and Strategies, Level 6
CS 1070	Introduction to Information Systems, Level 4
ES 3435	Sustainable Use of Resources and Waste Management, Level 5
MA 1001	Finite Mathematics, Level 4

¹⁹ Participants were informed that a rich Blackboard container is one using all the institutionally required areas (Course information, course policies, instructor information, outline, etc.) and at least two non-required features (Exams, forums, blog, assignments, etc.).

HT 4332	Event Management for the Hospitality Industry, Level 6
PH 2005	Business Ethics, Level 4

The reader should also take into consideration that several of the above courses are multi-section courses, while the institutional implementation of the LMS is providing one course container per section for the duration of the particular academic period (i.e. one semester). Only CS2240 and CS1070 offer an additional central container that is perpetual and constantly updated beyond the time span of particular academic periods. This means that students evaluating a particular course, most probably, have not experienced the same LMS container, (built by the same instructor) with those of others taking the same course.

Based on this evidence, a significant imbalance is observed. At a number of courses, students consider their course containers as of poor content while others enrolled at the same course but with another instructor, consider them rich. This may lead to the conclusion that different faculty teaching the same course make use of the TEL applications much differently (efficient usage vs. low or no usage

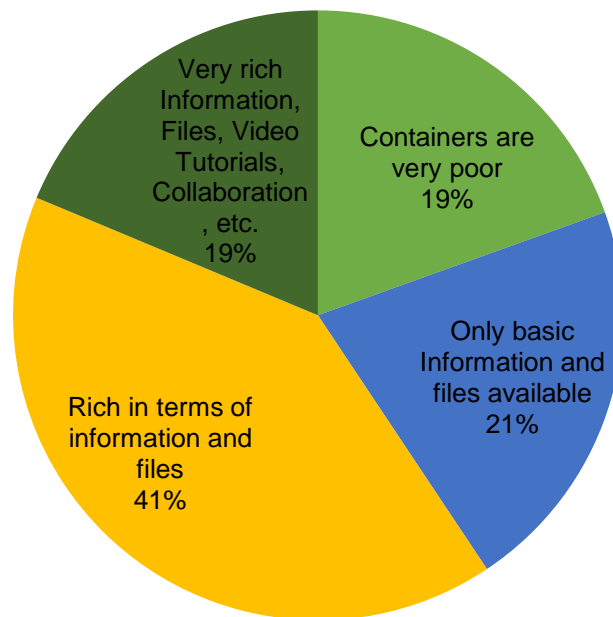


Figure 30: Academic Writing Module (Students)

at all). This observation has no correlation with the area of studies. There are also interesting observations in specific courses that are worth being examined.

Academic Writing is a course taken by all students in all programmes. A significant 41% of the students find course containers to be rich in terms of information and files. It seems that many instructors from the English Department possess the necessary technological knowledge and appreciate basic LMS features so as to invest time in updating their containers with lots of resources that may assist their students. Taking into consideration that the containers used by the English courses are reset at the beginning of each academic period, it is understood that the faculty is responsible for the backup and restoration of these containers at the beginning of the next academic period. It is evident how rich the outcome of their efforts towards knowledge accumulation would be if such recreation efforts were not a necessity at the beginning of every semester and just typical course updates would only be required. This is a classic error of the

implementation strategy of the investigated LMS. Technical experts implemented the institutionally purchased solution, probably based on a technical manual scenario, however without the consultation of LMS experts or experienced faculty in the use of LMS. It is also a strong indicator of not having a clearly implemented eLearning institutional strategy. This is one of the most commonly encountered challenges in systems analysis and design. The gap between what the users actually need and what the implementer eventually delivers. LMS implementation seems not to be an exception to this.

The CS1070, Introduction to Information Systems course (Figure 31), is another multi-section course that is mandatory for all students and need to register for it at the beginning of their studies. In this case a deviation from the average is observed by students who found these containers providing very rich information

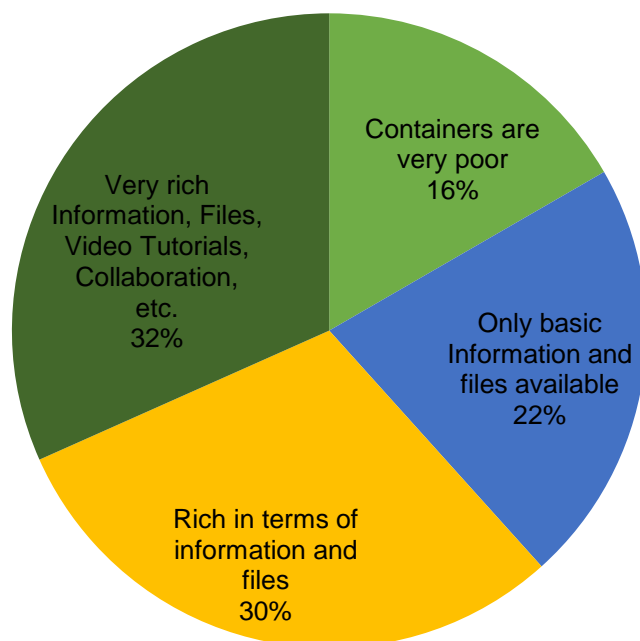


Figure 31: Introduction to Information Systems Module (Students)

through the use of more complex LMS application features. However, there is some compensation for that. At first, the faculty here has a higher level of

expertise in respect to Information Technology. Hence it is easier for them to overcome the technical obstacles that may burden other colleagues from different disciplines. In fact, students receive some LMS training at the laboratory session supplementing this course. This training is mostly an extensive presentation of the course's Blackboard container. Since this particular container was originally created for the needs of this research, it is one of the richest ones not only with respect to a very large variety of contents and activities but also because it was built considering principles of instructional design for education. Moreover, introductory courses such as CS1070 (Figure 31) and especially the technical ones offer a much wider horizon to experiment with a large variety of eLearning applications. Finally, an important advantage that CS1070 has compared to other courses is that an eLearning Central Course Management Unit container is available to these students, as part of this research. This container is perpetual, frequently updated and has implemented a variety of eLearning components for this survey. The advantage of implementing such a container is that it is made once and thereafter is incrementally updated. That way it requires less time to update, and may be updated by several instructors as in the examined case. Such collaborative instructor work reduces update time even more. Consequently, it may be assumed that a container following this logic is more frequently updated with less effort. Additionally, content redundancy is potentially eliminated thus reducing storage requirements and relative costs. Although CS1070 is not the core container used by this research and this "central logic" has not been widely accepted by all CS1070 teaching faculty, students do have a strong advantage in terms of the implemented available TEL in their course. Still, an important 32% believes that containers are poor or basic. This evidence shows, that even in this course that has a minimal central container, there are

instructors that not only do not properly use their section containers but also do not enroll their students nor update the central container. Bringing the issue to discussion with the faculty, it seems that instructors are reluctant to use the central container since it is not part of the official strategy of the institution. In fact, it seems that the actual reason is that given their overweighed schedule, there is simply not enough time to invest in updating section containers. At the same time the central one, while although technical expertise in their case may not require training for most features, it still requires a large amount of time to be invested in mastering the LMS to the level required for a properly designed cross-section central container.

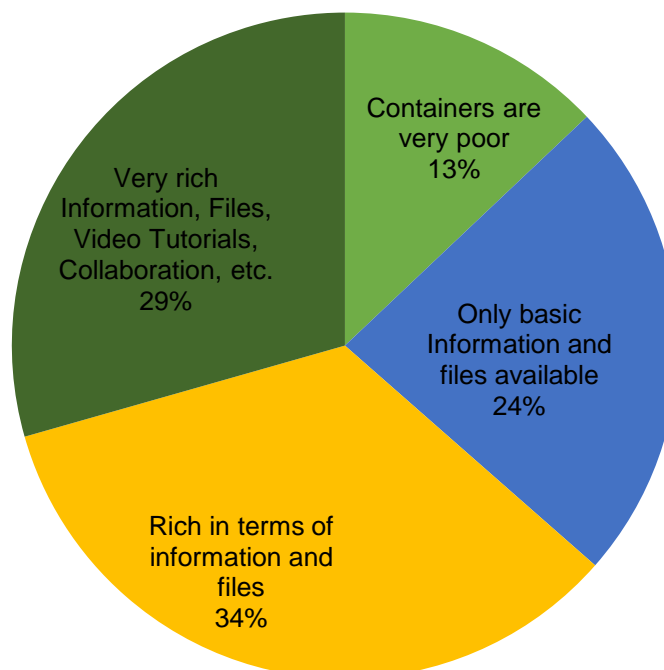


Figure 32: Electronic Commerce Module (Students)

Another notable case is the Electronic Commerce module (Figure 32). This is the core research module where a very wide variety of suitable eLearning features have been developed and implemented in both Moodle and Blackboard. In addition to that, this particular course, although not an introductory one, is mostly

suitable to promote eLearning features. For that reason, someone would expect that the number of students that have found its content rich, not only in terms of information and files but also in terms of more advanced eLearning features, would surpass by far those of CS1070. Although high (63%), it is just 1% overall higher than CS1070, while 3% more CS1070 students evaluate CS1070 containers to be using more complex eLearning features. Not only that, but also the astonishing for this course 37% of the students that reported that the container is poor or mostly basic, may be supported with the fact that only in the last year the eLearning Central Course Management container was implemented and became part of the eLearning Policy of the course. The majority of students participating in this survey have taken this course before the implementation of this logic to all sections of the module. Hence, it is expected that the statistics of this module will highly change as time goes by. Nevertheless, it would not be considered appropriate to only blame the delayed implementation of eLearning policy at the course, without at least considering other reasons that may have caused the above-mentioned observations. Although the teaching faculty of CS2240 are comprised by technical experts in a field that is technologically similar with LMS (in fact LMSs are considered as part of the e-Commerce theory and software wise it originates from Content Management Systems), only recently, few of them have made pedagogical considerations while implementing eLearning content due to their current research interests. So possibly, some eLearning features implemented are improperly designed and fail to attract students.

Finally, evidence observed with respect to the MA1001 module (Figure 33) provide a notable absence of eLearning content. MA1001 is another introductory,

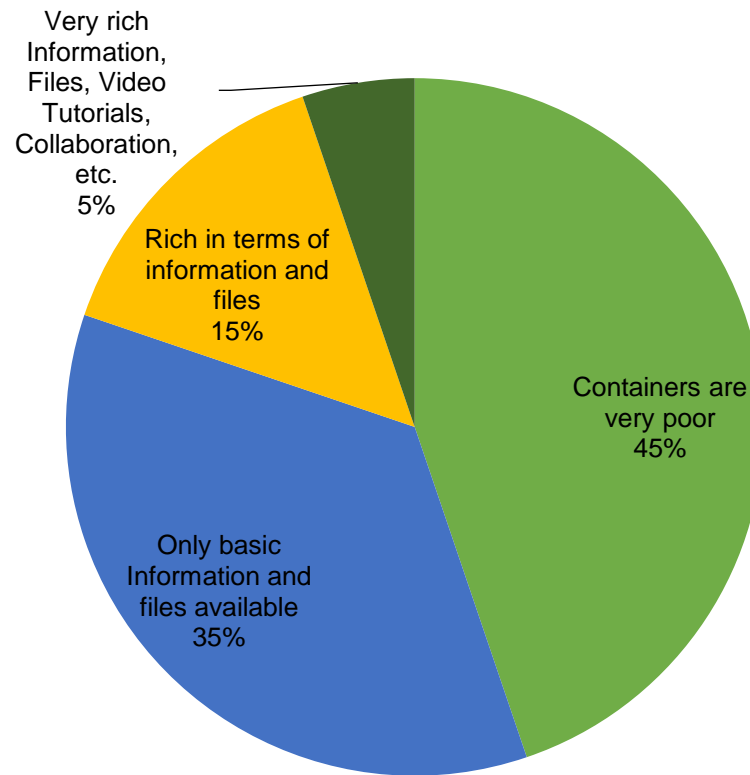


Figure 33: Finite Mathematics Module

multi-section course in mathematics, mandatory for all students during the first year of their studies at the College.

In this case, the exceptional observation is that 45% of the students, state that the containers are very poor and another 35% that they only contain basic information and files. So basically, an 80% of the students believe that TEL applications are very poorly used by the faculty! To the defense of the math's faculty, it should be stated that neither specialized math plugins nor any other math oriented eLearning application has been made available to the institutional LMS. Hence, even developing content that is as simple (e.g. text with some mathematical annotations such as equations becomes very difficult to achieve.

However, LMS usage reports show that a significant number of instructors does not even update operational information like outlines, office hours, etc. Nevertheless, the argument here would be that such information can still be serviced, not so efficiently, still effectively, through the traditional way. At the same time, a container with only that kind of data would not have been so attractive to students in order to notice it. Conversely, this claim is negated by the fact that in section *Students' evaluation of various LMS features* section of this report, it was shown that areas containing information like <Course Information> or <Faculty Information> or <Course Documents> are among the most popular between students although most of these data are not linked to the learning objectives of the course. Since students expect to find them in electronic form through the web, it is needed to strongly consider it as an operational quality service to them.

Lastly, MK2050, EC1000 (both introductory courses required by most business students) and AF3105 have also a bit more significant than the average number of students that state that their content is poor or basic.

Concluding, based on this survey, student responses and Blackboard usage data indicate that eLearning implementations are not accessed adequately or at all by many students. Such behavior is observed even in the case of containers that were built taking into consideration current instructional design best practices. However, there is no indication that the technologies addressed are having any deficiencies in terms of supporting eLearning models. The challenges found are not related to technology. The only exemption seems to be e-Mail, which has largely lost its effectiveness as a communication tool by failing to update students. Other, more effective methods, should be investigated to resolve this.

4.3 Learning management Systems in Higher Education: An Instructor Perspective

Following the Students' perspective survey of the previous section it was found appropriate to also examine the instructors' perspective as well. That is because the learning community is comprised by both students and instructors that altogether participate and affect the productivity of the eLearning implementations. In addition to that, to confirm the validity of students' opinion and the deducted assumptions derived from student survey with respect to instructors use of LMS. Finally, instructors, are expected to develop eLearning activities, so their role in the eLearning ecosystem is of particular importance.

This survey analyses how the implementation of an LMS affects the learning outcomes from the viewpoint of the higher education instructors. In order to understand the faculty awareness of LMS systems, data from the university environment were collected to provide an opportunity to compare and contrast opinions. It is also important for the academic sector, to understand and measure productivity achieved through the LMS implementations from the perspective of their instructors. It is required so that they can appropriately adopt them in their curricula. Based on the evidence provided from the literature review so far, it was found to be recommended that at least basic faculty training is required after installing a web based LMS. That would help create module content that could further improve learning compared to the traditional methods of just disseminating course materials using a few basic LMS features. However, basic training by itself will not offer any significant advantage towards the learning objectives of Higher Education, suggesting that a more specialized and continuous training is required. Furthermore, a complete learning strategy needs to be established to fully utilize the potential of current learning applications and keep faculty updated

to the continuous introduction of new technologies in the sector. Finally, the analysis of the student survey results, establishes that there is a communication deficiency with respect to how current web-based eLearning platforms communicate eLearning activities which demotivates students and instructors to engage to those activities.

4.3.1 Methodology

The survey studies which features and tools of an LMS are mostly used by faculty and the environment within which the faculty develops these applications. Additionally, instructors were asked to evaluate their experience and training with respect to pedagogical and technical expertise required for developing inductive LMS. Finally, they are inquired to evaluate the student perspectives of LMS and the institutional strategy implemented in their organization.

This survey was also conducted to further explore and confirm several issues of current eLearning implementations based on the findings of the student survey. Thus, it was considered appropriate to be aligned. Furthermore, since this survey was also run at Deree College, it should also follow, and be limited by, its academic program and calendar that also determines the availability of instructors. Consequently, the methodology implemented follows the same logic, approvals, communication and technologies used for the students' survey in the previous section.

The survey was delivered to a sample size of 100 faculty members (largely from Greece, but also from UK) from a variety of disciplines and higher education institutions which offer graduate and postgraduate courses in various programmes including liberal arts, business administration, communications, and sciences.

4.3.2 Demographics

The participating staff in this survey were fairly evenly distributed with a 54%/46% split between female and male populations. The largest population of staff belong to the 45-54 age group, while the second largest group is that of 35-44. Examining if there is a correlation between the age group and what faculty members believe LMS use is best for; it was found that faculty in the age groups from 35-54 (70%) strongly believe that LMS is a very good if not the optimum tool to be used as a repository of course materials (Figure 34).

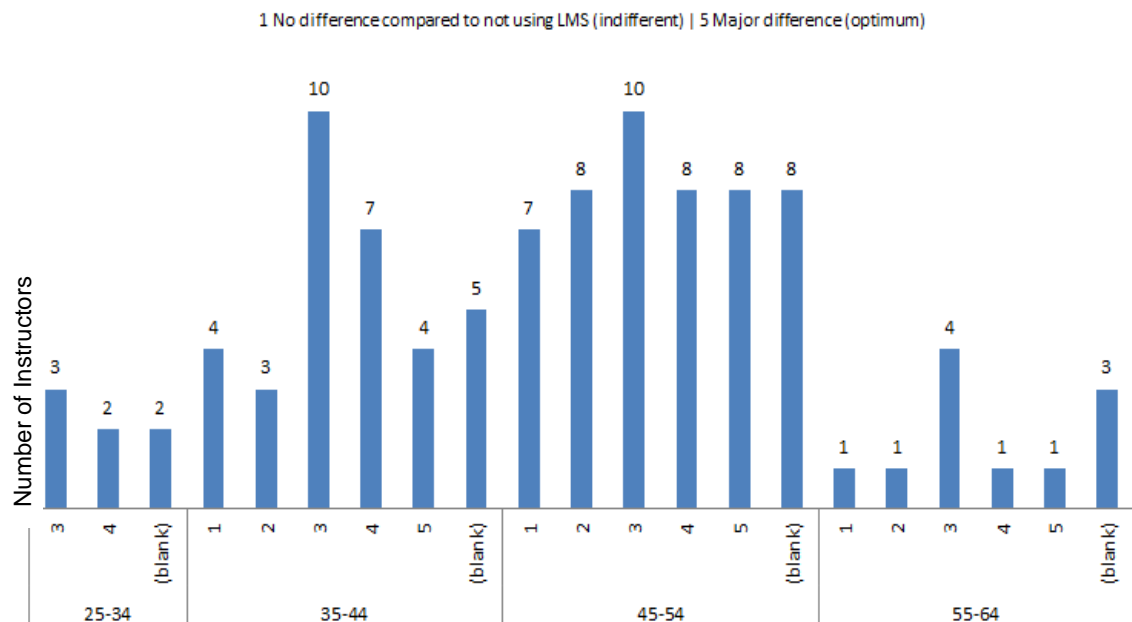


Figure 34: Faculty evaluation of LMS as a repository of materials tool

Most of the participants are staff from the Greek private higher education institutions (72%), while the rest of the faculty comes from Plymouth University and the National University of Greece as shown in Figure 35. It was considered that the location of staff was not a variable of importance, as the purpose of the study was to focus upon individual staff perspectives and their experience (which may have been gleaned from a variety of previous institutions at which they worked).

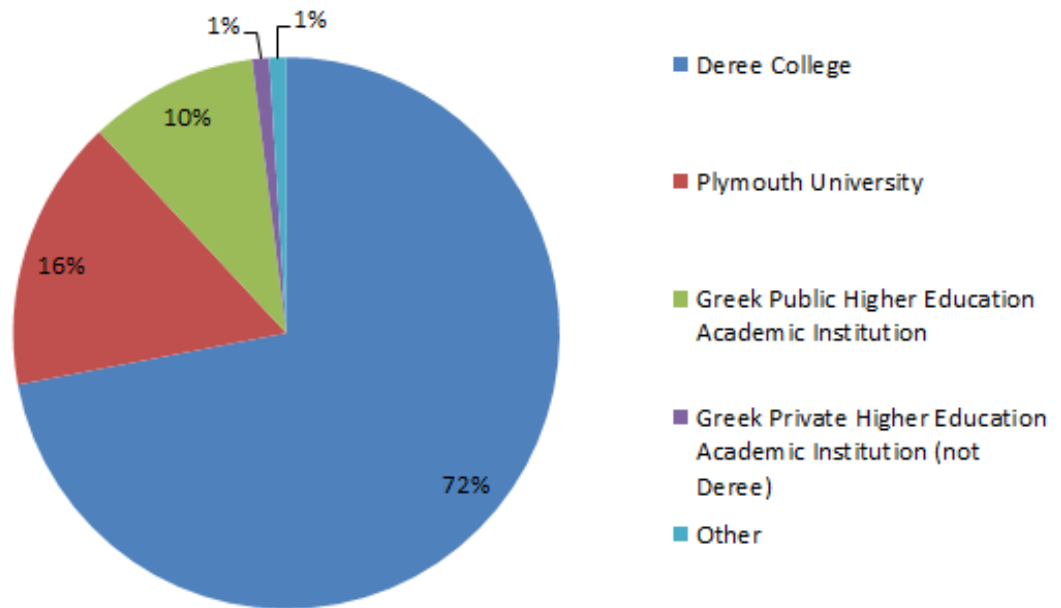


Figure 35: Staff Origin

The survey was distributed to staff from a large variety of disciplines; however, as the LMS is an Information Technology tool, they were grouped into disciplines that have an IT background and those that have not, as seen at the following chart in Figure 36.

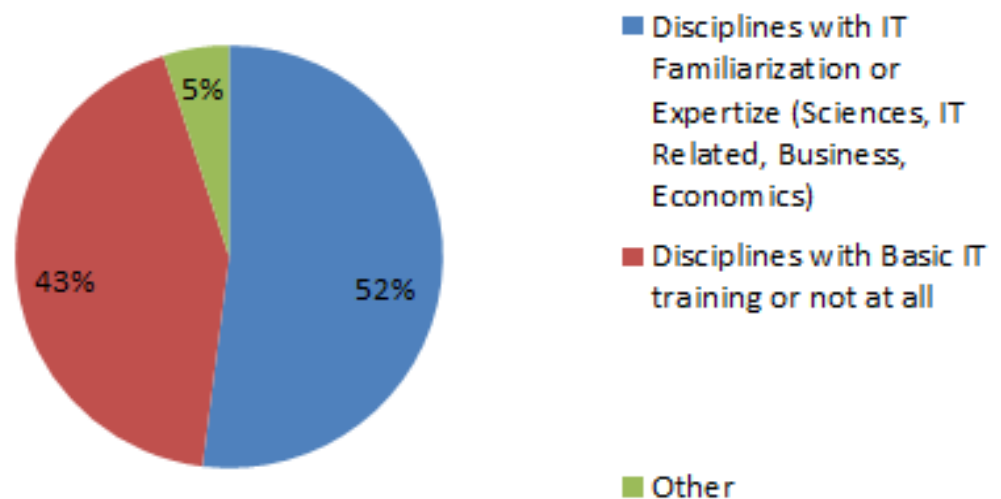


Figure 36: Staff disciplines based on IT background

4.3.3 Environment to Develop LMS

LMSs and especially the advanced features which assist in developing constructive on-line learning modules obviously rely to: a) high speed access to the Internet due to the size of data that needs to be uploaded, b) availability of software to develop such contents and c) a work environment that enables staff responsible for eLearning development to concentrate and be given the time in order to be productive.

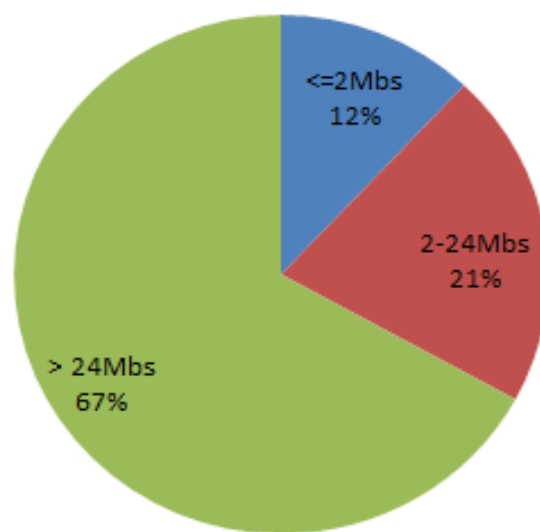


Figure 37: Staff Office Speed of Access

As seen in Figure 37, the survey indicated that the speed of Internet access available to the respondents is adequate for most of the participants.

Only in the case of a relatively small proportion of participants (12%) there may be difficulties. However, when questioned whether staff are stationed at an office that is suitable for creative academic work – which is a necessity for the development of constructive LMS modules – an impressively large percentage of 44% responded “no”. This portion was derived from the whole faculty surveyed and is irrelevant to faculty discipline. The characteristics of what is considered a “suitable” environment for creative academic work were stated as a quiet office shared with a couple or no colleagues at all, while at the same time, having

access to the hardware and software resources was considered a necessity. This suggests that 44% of participants may be unable to cope with the demanding tasks of developing constructive LMS modules.

4.3.4 LMS Faculty Use Analysis

Based upon the analysis of the surveyed data 24% of the total staff do not use an LMS at all. The remaining 76% of the faculty are using the following platforms as portrayed in Figure 38.

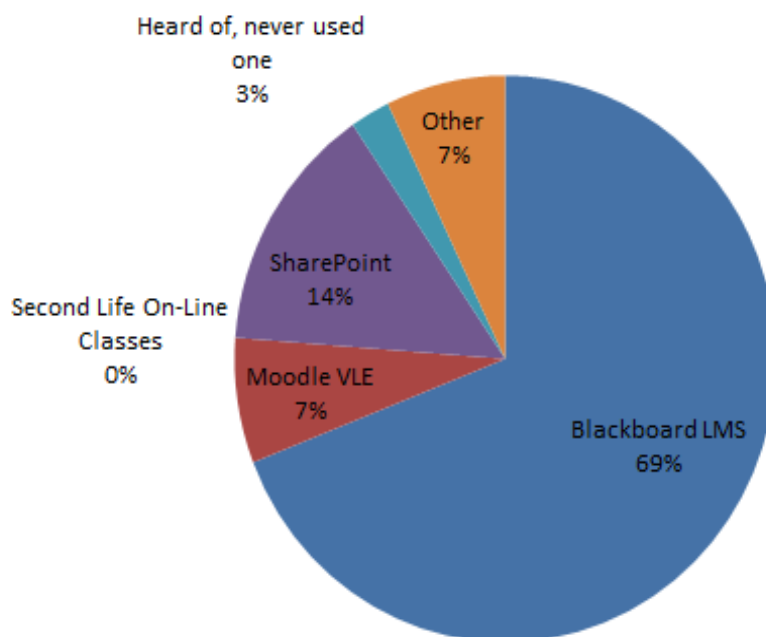


Figure 38: LMS platforms used by faculty

From those LMS platforms, Blackboard (Blackboard, 2013) and Moodle (Moodle, 2013), which correspond to 76% of the platforms used by the respondents, support the creation of advanced constructive learning modules. SharePoint using Tulip that is offered by Plymouth University is basically used as a repository (CMS) system according to the Technology Enhanced Learning of Plymouth University web page (*Pedagogic Support for Tulip*, 2013).

As shown in Figure 39, most of the staff use an LMS mainly as a Content Management System (CMS), while very few of them use the tools that may lead to creating a constructive learning environment. The only one of those functions

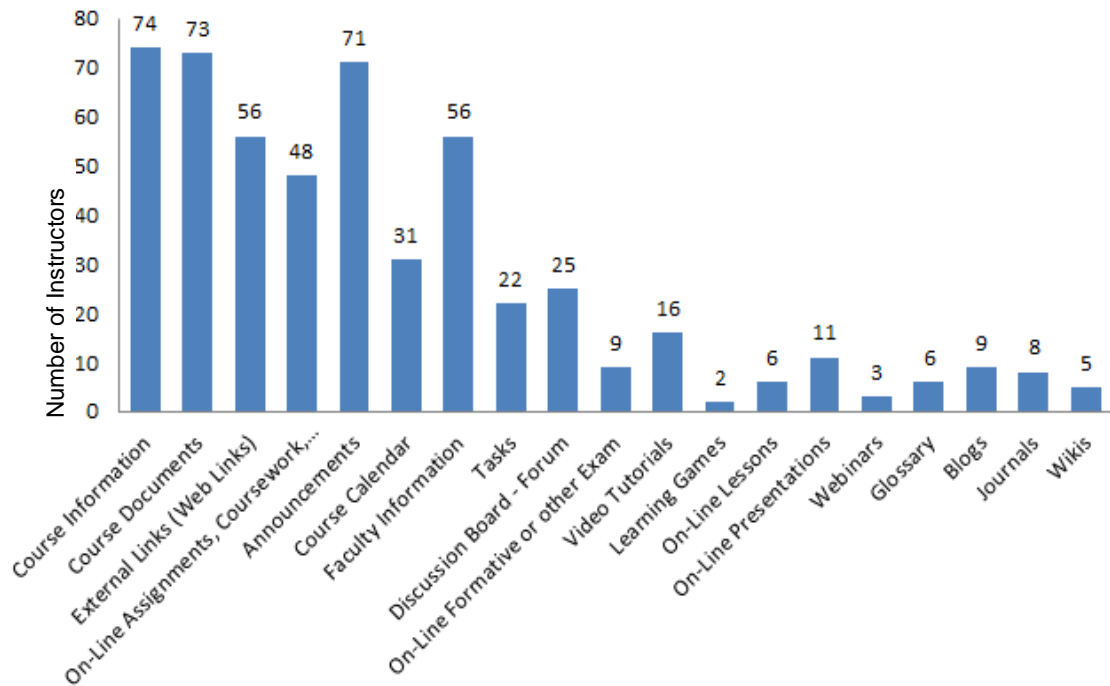


Figure 39: eLearning functions used by faculty

that seems to be somewhat more popular is Forums. Blogs, Journals, Wikis, Learning Games, etc. are not among the preferences for the vast majority of the faculty, which mostly favors Course Information and Documents, Web Links, Announcements and other functions, which used for reasons depicted in Figure 40 and Figure 41.

Furthermore, LMS constructive learning functions require in many cases third party software such as Interactive Video Editors to produce Video Tutorials and SCORM Editors (*Advanced Distributed Learning*, 2012) to produce interactive lessons. According to the survey, only 16% of the total surveyed faculty has ever used such applications.

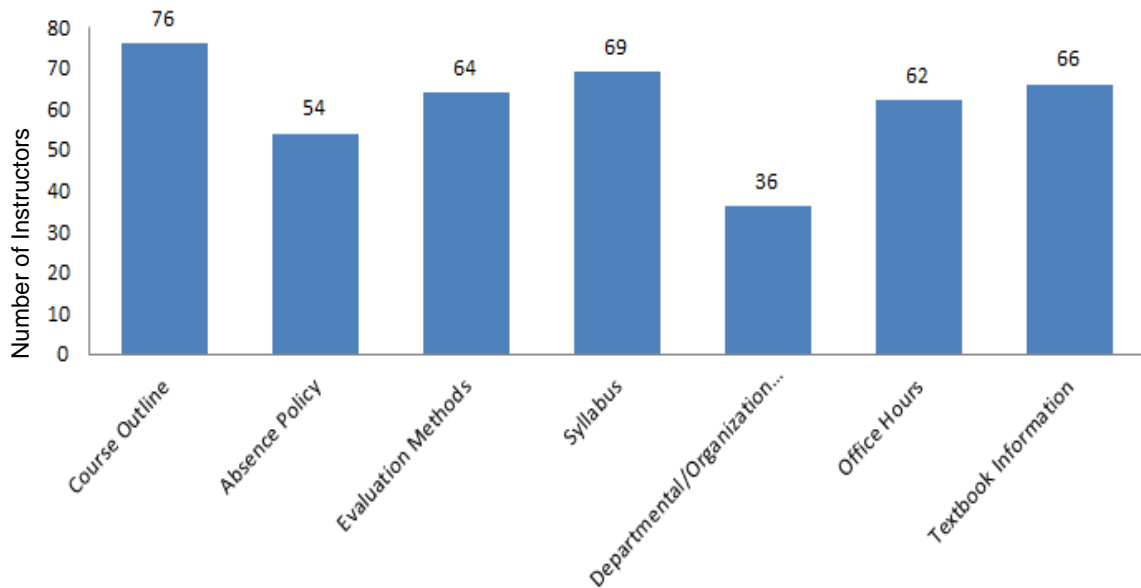


Figure 40: Course information usage (Instructors)

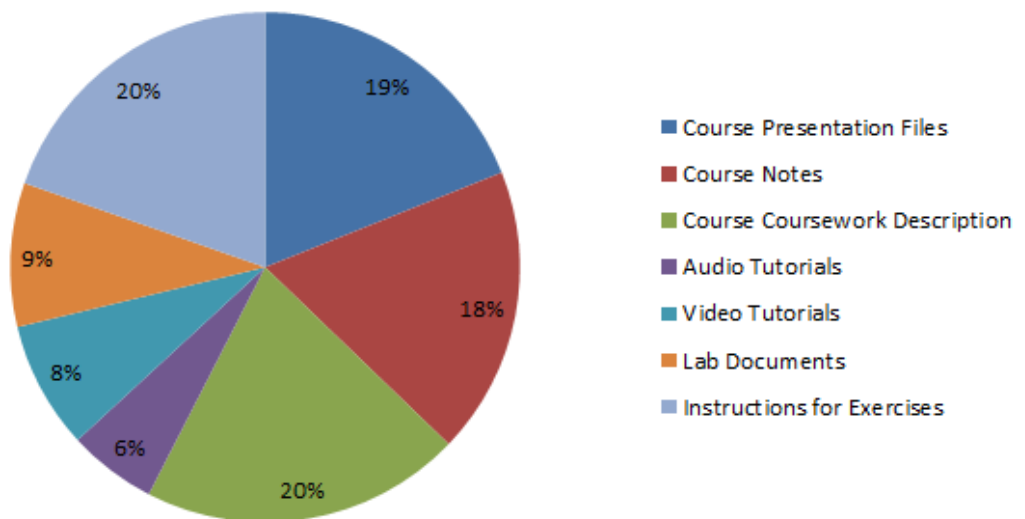


Figure 41: Files offered via LMS (Staff)

Summarizing, although most have access to LMS's that support constructive learning functions, staff still prefer to use the offered LMS as a repository of information, which in most cases is not related to the learning process but to communicating administrative content and policies related to the module they teach. There are likely many reasons for this:

1. According to Britain and Liber (2004), "*Education providers using LMSs and other ICT tools for e-learning have two primary aims: to enhance the*

quality of teaching and learning by allowing teachers to use pedagogies that are not possible with large numbers in a face to face environment and to manage the delivery and administration of programmes of learning through an electronic (on-line) medium". To achieve this, both technical and pedagogical awareness is required, so the questions that may be raised here are:

- a. Does faculty have the technical knowhow required to develop such learning modules?
 - b. Does faculty have the pedagogy background required?
2. The faculty does not have enough time to develop such learning modules?
3. Does Faculty have enough contact time with students to enhance lectures with constructive LMS modules?
4. Constructive LMS modules rely upon the following:
 - a. Content that builds with time and not in one academic period, hence relies on the interactions of many past and present students similarly to an expert system.
 - b. As a result of continuous content accumulation, LMS relies to the ability of IT to support big data collections.
 - c. This can only be possible if adequate resources are offered by the implemented LMS technologies.
5. Current means used by eLearning platforms to communicate updates of eLearning activities to learners are not sufficient to effectively fulfil the task. As a result, learners' engagement to eLearning is depleted.

Faculty Opinions on Various LMS Aspects

In this section, staff are asked to evaluate various LMS aspects including:

- the training they received,
- what training they should have received, and
- their thoughts towards why students do not use the few implemented constructive LMS modules.

Faculty Training

The surveyed faculty was asked if they have received any training relative to the eLearning Course Management System their institution is using (Figure 42). An impressive 32% of the faculty had not received any LMS training at all, with most of the respondents originating from the UK (Plymouth) and the Greek National Public University.

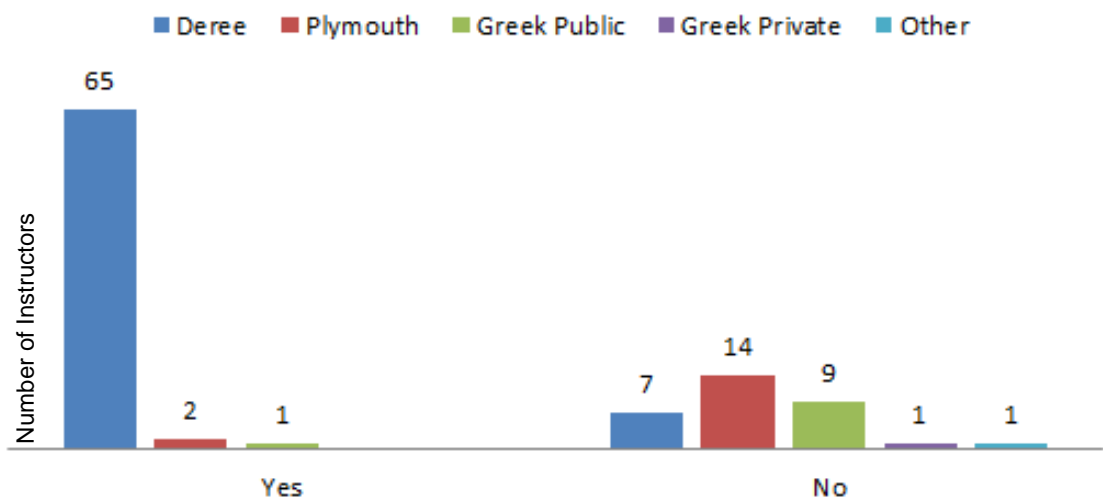


Figure 42: Faculty LMS training

The remaining 68% of the faculty that stated they have received LMS training was asked to evaluate it both in terms of time and content sufficiency. The results are displayed in Figure 43.

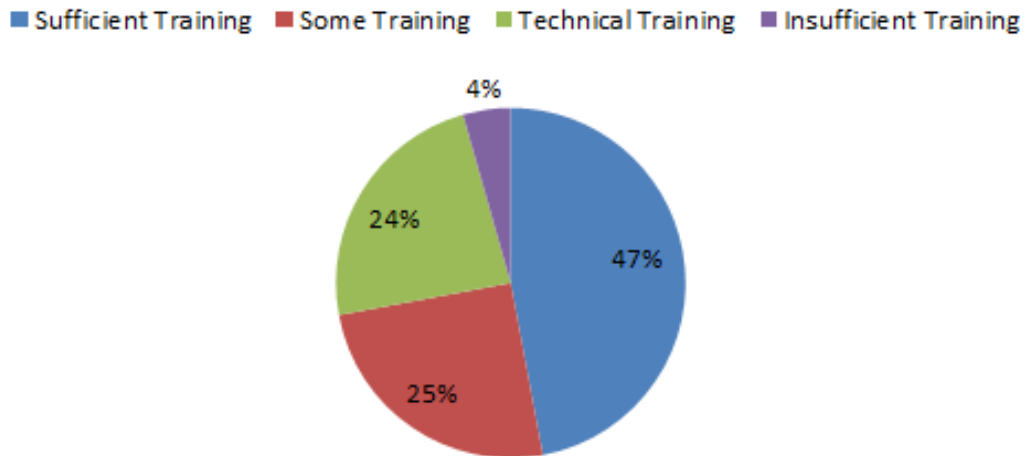


Figure 43: LMS Faculty training sufficiency

Less than half of the responders (47%) believe they have received sufficient training. 24% responded that they have only received technical training on how the application works but no training on how to use this knowledge from a pedagogical point of view, which is a requirement for implementing constructive LMS modules. Finally, 25% of them claimed to have received some basic technical training, yet far from what is required to technically implement the advanced LMS features.

To examine the reasons for the above stated inefficiencies, the surveyed faculty were asked to provide the background characteristics of their trainer, which are displayed in Figure 44. Because Deree did not introduce pedagogical and eLearning instructional design training during the time this survey was conducted in 2016 but much later, this question intends to verify if trainers did have any pedagogical background so as to provide at least technical training that may include some educational characteristics.

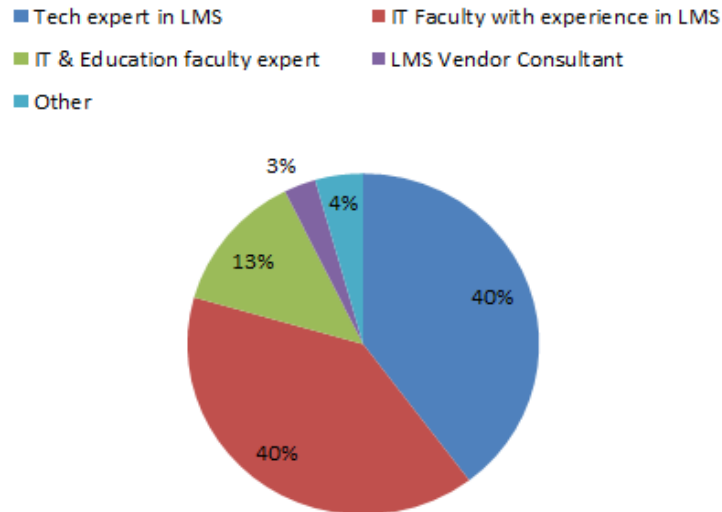


Figure 44: Trainer background characteristics (Instructors Training)

As illustrated, 80% of the staff responded that the trainer was an IT expert specializing in LMS or a member of IT staff experienced in LMS. In both cases this indicates that the background of the trainer was from IT so it is safe to conclude that the majority of the respondents have mostly received technical and not pedagogical training (which arguably is not of equal value). Only 13% of the respondents identified a trainer with the combined characteristics that are expected for the creation of constructive modules and an almost insignificant 3% were trained by a vendor consultant (like a Blackboard representative) who might have included in their training some examples of constructive implementations. Since eLearning instructional training had not yet been offered to instructors at Deree, it was assumed that the 13% of respondents that indicated they have been trained by IT & Educational faculty expert mostly refer to IT Faculty with experience in LMS or online training, online research and personal contact with eLearning experts.

At this point, staff were asked to state their opinion by evaluating their training needs in the following areas: a) General training in IT with focus on LMS b)

Specific LMS Training c) Pedagogy and Education Training d) IT, Pedagogy and Education Training

The findings are illustrated in Figure 45²⁰. A further analysis of these results gives rise to the following observations:

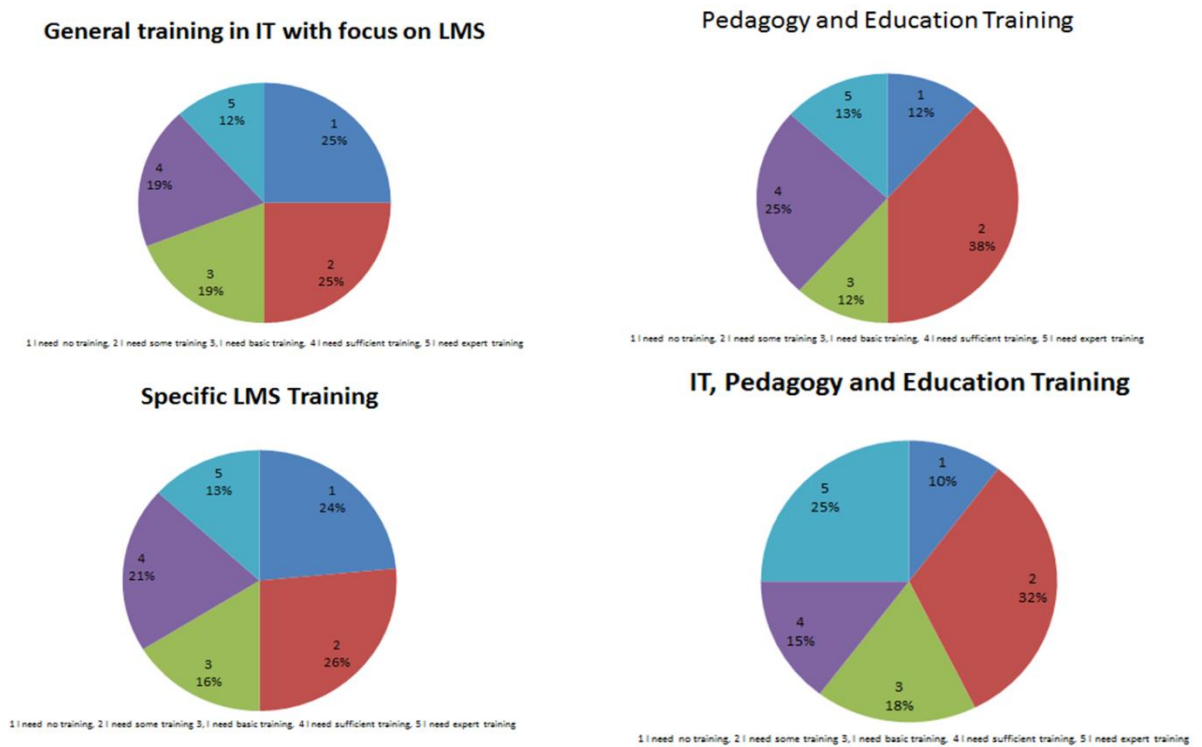


Figure 45: Faculty opinions about LMS training Needs

- 31% of staff believe they need more sufficient or expert general IT training focused upon LMS. This is justifiable considering that the majority of the staff originates from disciplines that do not provide in-depth IT background as shown in Figure 36 earlier in this chapter. At the same time however, 50% of the faculty believes they have adequate technical awareness with respect to the requirements of LMS applications.
- Expert trainers with respect to LMS are required according to 34% of the respondents, while 50% of them do think they need little or no training.

²⁰ The scale below the pie charts in Figure 45 reads: 1. I need no training, 2. I need some training, 3. I need basic training, 4. I need sufficient training, 5. I need expert training.

- 38% of the respondents believe they need more sufficient or expert training in pedagogy and education in order to implement LMS solutions – with that being more important than IT training since most of that faculty consider that their IT awareness is adequate for LMS applications.
- Surprisingly, 50% of staff believe that they only need some or no training at all with respect to pedagogy and education although their background (for most of them) is not related to pedagogical disciplines. Arguably, only when required to develop a constructive LMS module one may realize their weaknesses in terms of the pedagogical awareness required.
- Finally, 40% of the respondents think they need more sufficient or expert training in both IT and pedagogy concepts with respect to LMS applications.

At this point it is needed to observe that the responses recorded in Table 4 are based upon those staff who responded that they had undertaken training offered by their institution. In other words, the key observation here is that almost half of the staff did not consider that training was sufficient to deploy constructive LMS modules both in terms of IT and in terms of pedagogical and educational needs.

To understand in more depth, the awareness of faculty with respect to IT and pedagogical concepts involved in LMS, staff were asked to identify a familiar a set of terms that have direct relationship to LMS. These terms and the faculty responses are recorded in Table 4 below.

Table 4: Faculty familiarity with LMS related terms

	Yes	No	Uncertain
Positivism	41	38	21
Wiki	78	11	11
Video tutorial Authoring Software	34	41	25
Webinar	68	16	16
Constructivism	42	35	23

4. SURVEYING STUDENTS & INSTRUCTORS ON ELEARNING IMPLEMENTED TOOLS

STAR Legacy	1	85	14
Forum	78	9	13
Learning Blog	51	20	29
Learning Journal	44	23	33
Average	51.1	28.7	20.2

The evidence shows that at average 29% of the faculty is not familiar at all with those terms, while a further 20% are uncertain about the provided terms. Exemptions to these are observed with respect to Wikis (78%), Webinars (68%) and Forums (78%) where staff seem to be largely familiar with them. Of course, the terms correspond to technologies that are very popular in the web; however, arguably in most cases, due to websites that are probably not related to LMS. Yet, although faculty seems to be familiar with those, they are the most demanding ones with respect to both IT and pedagogy background required, in order to develop, implement, administer and monitor. Considering the training insufficiencies spotted above, it seems very difficult for most members of staff surveyed to properly use such options.

One would expect that the younger faculty age group would mostly favor the use of LMS. However, it seems that older members of staff place more faith in them

in all four characteristics including their ability to assist in achieving the course learning objectives as shown in Figure 46 below.

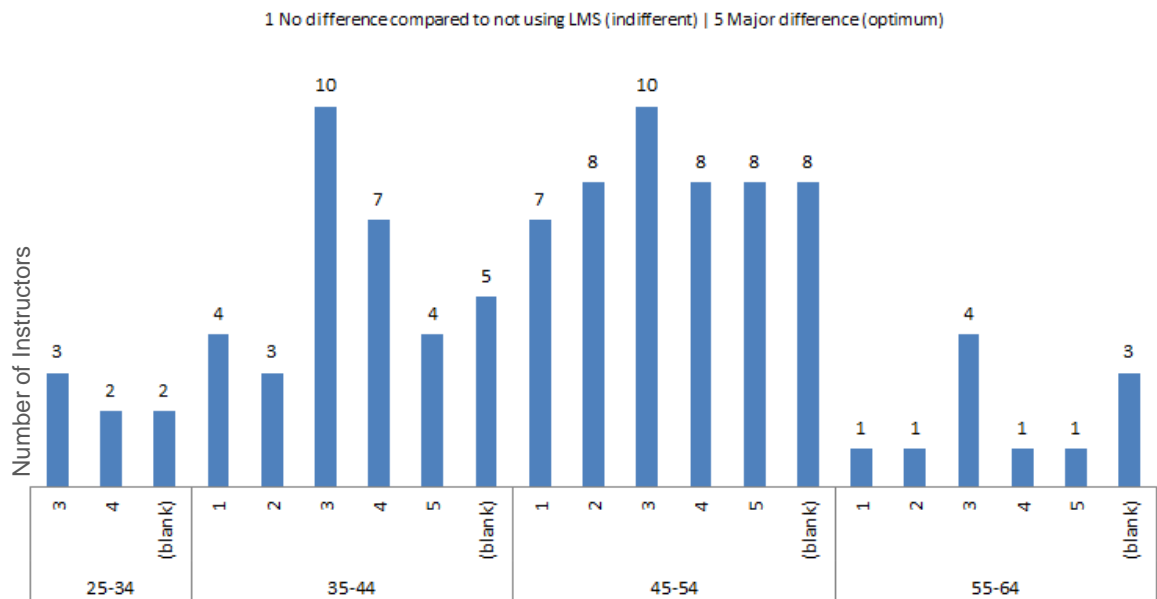


Figure 46: LMS best used for learning objectives per age group (Instructors)

Finally, staff was asked if – due to the implementation or administration of the LMS they use - they have to recreate all content per module and upload them to LMS at the beginning of every academic period. 33% of them responded that they have to go through this process. Since many of the constructive functions of LMS, like forums, wikis, learning blogs and journals do relay on data that is accumulated over time, this would be a major technical barrier for implementing such features. Imagine uploading several Megabytes or even Gigabytes every semester. This is easy to resolve technically if IT administration responsible for the management of LMS is guided by an eLearning expert to implement the institutional LMS in a way that favors the objective of learning. Otherwise, it is likely staff that will merely choose to use the LMS for basic activities.

Faculty evaluates student views of LMS

According to the survey presented in ICERI 2012 (Triantafyllidis, 2012), 35% of students in higher education who did have access to a LMS in their institution,

claimed that have never seen any LMS technologies implemented for their courses due to the fact that their instructors did not implement or promote LMS solutions. The faculty in this survey was asked to offer their opinion about the reasons leading to that fact. The outcomes of their responses are listed in Table 5:

Table 5: Faculty evaluation of reasons on why students have never seen LMS implementations

Reasons	Very to extremely important
Not enough Faculty Time to develop LMS	41%
Inadequate IT Faculty Training	55%
Inadequate Faculty Pedagogy Knowledge	47%
Not enough Classroom Time	37%
Missing Complementary Apps	34%

All five possible reasons regarding the students' feedback on LMS implementations were considered very important to staff with the highest being the insufficient training both in technical knowledge and pedagogy awareness required.

Similarly, based upon the same study observations, staff were asked to evaluate in terms of importance the reasons why 30% of students that have seen LMS implementations in their courses have never been exposed to more advanced eLearning features such as video tutorials, forums, journals, wikis, etc. The faculty evaluation of reasons is presented in Table 6.

Table 6: Faculty evaluation of reasons on why students exposed to LMS have never seen advanced eLearning features

Reasons	Very to extremely important
Not enough time to develop LMS	53%
Not enough IT training	60%
Not enough pedagogy training	54%
Not enough classroom time	42%
Unavailable supplementary apps	49%
Ignorance of LMS advanced features	22%
Features not supported by installed LMS	29%

A very interesting observation on the above evidence is that from the 29% members of staff that responded, questioned whether features were supported by the installed LMS. 86.4% of them are working in an institution that does offer to them an LMS that actually supports the mentioned features (video tutorials, forums, journals, wikis, etc.)! Since Blackboard supports many of these features it seems that 29% of the instructors either do not know them or they do not have adequate knowledge to identify them.

eLearning Strategies Department

Concluding, the surveyed staff were asked to report if there are specialized personnel available for the development of eLearning strategies in their institution. The evidence is presented in Figure 47, only 15% of the respondents have identified a department dedicated to eLearning strategies in their organization, while a large 47% reports that the LMS is just another IT application

handled by the IT department. Perhaps the fact that the corresponding department is relatively new explains why many instructors do not know it exists.

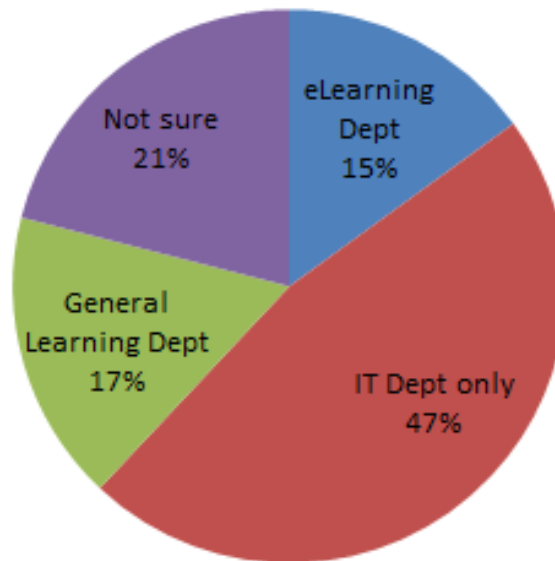


Figure 47: eLearning strategies support department (Instructor's opinion)

4.5 Discussion

So far, the conclusion derived is that by buying and installing eLearning technologies by itself will not deliver the expected objectives in relationship to students' productivity towards learning outcomes of the various courses. The survey has depicted the following weaknesses:

1. The Institutional eLearning Strategy should become clearer. The evaluation of currently implemented technologies, the design of strategic procedures towards the institutional use of eLearning applications, also training of faculty should be empowered by a group of people with background in both technology and education combined with pedagogy. As Lytras (2001) clearly states, eLearning may only be successful if it is believed as a value adding processes that challenges the way of teaching. Otherwise it may be just a waste of time and money. So in order to have our expectations met, it is needed to consider eLearning among the top

envisioned strategic considerations of the institution (Brew and Ginns, 2008).

2. Faculty needs multidimensional training. They don't just need to learn how the particular features work but also what are they useful for. Simple technical training has been considered boring and a waste of time. Additional scholarship of teaching and learning is required in alignment with technology. Besides, research indicates instructors who engage in the scholarship of teaching and learning create a positive effect to changes in student's course expectations (Lytras and Pouloudi, 2001). Furthermore, informed users that have been convinced at least for the operational benefits, the economy of time and the cost savings that TEL applications offer would probably not require more than some fast training presentations followed by Q&A sessions. Then they may be forwarded to learn the specifics through tutorials that can be made available on-line. A great idea would be to use the institutional LMS to train the faculty. Training should be among Institutional eLearning Strategy goals.
3. Training sessions for students on what TEL options are available and how they are used. It is logical to expect that students may completely ignore what they do not know. Currently a small presentation of the institutional LMS is included to the laboratory sessions supplementing the Introduction to Information Systems course, which might be another reason of the high appreciation that students of this course have towards these applications. However, this training is not standardized and it is also delivered by instructors that, rightfully or not, do not implement most of the LMS features in their section containers. Additionally, many of those instructors have not attended an eLearning course or seminar thus their knowledge

is limited to technical expertise that is beneficial but not enough. These may be the reasons that such a significant number of students, report that they have never seen a feature or certain types of contents even in their courses' LMS, where it is known that such instances are available.

4. It is obvious that eLearning cannot succeed institutionally without the active and very demanding involvement of the faculty. For that, in order to be successful and provide long term benefits, it is needed to consider the particularities of the attempt. This cannot be considered as just another small extra job for the faculty to be involved into. Mental concentration, creativity, experimentation and research are required to be qualitatively productive. Time needs to be made in the already overwhelmed faculty schedule and some compensation should be considered for those involved. Alas there is a country-wide, if not global, financial crisis. No matter that, volunteer work is great and hopefully much appreciated but not enough for a serious strategic project. Forming a small multidisciplinary group of experts that will be responsible for the creation of eLearning content and activities for various course modules can be an additional or alternative approach.
5. Some of the most productive eLearning features cannot fit in the current evaluation system. Several of those were presented as part of the formative assessment of the course but they failed to reach a large number of the students if not part of a summative assessment or a certain bonus. It has been discussed at previous sections of this thesis that students are not motivated by the rational of what these contents will offer in their progress or future. At the same time, in courses where a more serious

effort towards eLearning features was attempted, there is evidence that students exhibited interest for and embraced these technologies.

6. Current eLearning platforms have not utilized the benefits of modern on-line and mobile technologies. They rely on email messages and internal notification systems to inform learners of updates in eLearning activities. These forms of communication seem not to be efficient enough today where other methods have become mainstream like communication messengers and social media.

LMS software has been established to offer a platform for building eLearning content and activities. Although the implementation of positivism methods seems to be easily achieved, based on the first survey, examining the students' perspective on LMS (Triantafyllidis, 2012), but also this current survey on instructor perspectives on implemented LMS, it was found that achieving inductive LMS applications is distracted by several challenges.

It is clear that a very significant percentage of the faculty responsible for the development of LMS content and activities claims that instructors do not have sufficient training and support both in terms of technical issues involved and in terms of pedagogical background, specific to the TEL applications required. Additionally, the survey exhibits that faculty does not have enough time to invest towards building inductive LMS.

An institutional learning strategy should be empowered by eLearning experts with background both in technology and education. They should be responsible for training but also supporting the faculty both in technology and educational aspects required to develop LMS-based applications in accordance to the institutional learning strategy. Most important, they should be responsible for

recommending the institutional eLearning strategy in alignment with the institutional learning strategy. It is evident from the survey that this role cannot be implemented by the traditional IT Departments in higher education institutions.

Developing LMS courses is frequently equal if not bigger in terms of time invested in development and delivery of a traditional course. The target group, students, are the most complex, diverse and at the same time “sensitive” group in our society (Triantafyllidis, 2012). It is important to remember that they are the future of humanity and thus need to be treated sensibly and responsibly. In addition, investment is required in acquiring the technology and training required to adequately supplement the LMS platform. Inductive LMS applications require mental concentration, creativity, experimentation and research to be qualitatively productive. As it is already stated, eLearning may only be successful if it is believed as a value adding process that challenges the way of teaching (Lytras and Pouloudi, 2001).

4.6 Conclusion

Concluding, there is a lot of space for improving eLearning in terms of administrative best practices and strategy but also in terms of training and organizing staff towards that aim. However, since this approach requires administrative and systemic reengineering possibly at institutional level it would require adoption of a long-term strategy and thus changes and results should not be expected soon. Under the current conditions, but also for the future, considering all involved parties, administrators, instructors and students a technology providing the following benefits would have been much appreciated:

- Increase the engagement of learners preferably to constructive on-line activities.

- Decrease the time spend to build and monitor such activities
- Promote interactivity
- Is easy – common sense – to learn and use
- Does not burden the budget of the institution
- Can be used as complementary to existing learning practices
- Addresses opportunities on current successful on-line services such as social networks, etc.

Nevertheless, based on the surveys conducted in this chapter and despite the above promising benefits, eLearning implementations do not attract a satisfactory number of students throughout all type of eLearning activities and contents. The research so far has indicated that in Blackboard containers, where best practices of current eLearning instructional design principles have been followed, although the access population and possibly the engagement of students was increased, still there are still big numbers of students that they never access the eLearning content or activity, or their interaction is shortly fast-reduced indicating non-engagement. One important reason for that seems to be related with the inefficiency of communicating eLearning activities mostly via automated emails. Other reasons, especially for distance learning students, may play a role. For example, complexity and time required to access and respond to such activities when only mobile devices are available.

Considering all, a Mobile technology started to become the center of the focus. Literature review so far has exhibited the unique value-adding features of Mobile technologies. Since the option to find a way to technologically improve current LMS was removed for reasons already explained, there was a strong consideration on how to design a mobile technology that would bring the benefits

of mobile technology in learning using existing learning platforms. Additionally, the popularity of Social Networks was also considered as a means to expand the reach of LMS features and learning to larger communities taking advantage of the tools offered by these technologies.

Following these considerations the following chapter offers an innovative theoretical mobile TEL application design that promises to deliver all the above stated options but also attempts to assist in the creation of a ubiquitous virtual learning community of engaged learners. In the development of this model all aspirations of the different influencing parameters have been considered. Therefore, current mainstream technologies, cost of development and maintenance, mobile user requirements, distance learning requirements and communication effectiveness were addressed. Having that in mind, a theoretical model was developed, that promises to assist in the increase of the access and engagement of the members of the learning community with the current institutional eLearning platforms.

5. eLearning Mobile TEL Application: Specifications, Analysis & Design A of a Theoretical Prototype Model

In this chapter, a Mobile TEL application theoretical prototype model is presented.

The objective of this model is to propose a mobile application design and its specific features that may lead to the development of a mobile application that will enhance the currently used by Higher Education web-based eLearning platforms.

5.1 Introduction

Based on the research so far, it can be seen, that a rich variety of learning theories and methods can be implemented using modern institutional eLearning platforms in higher education. Implementation challenges still exist such as the joint requirement for both technical and pedagogical expertise, time and money limitations. However, other solutions such as instructional design expertise that may even include non-eLearning technologies such as social media (DiVall and Kirwin, 2012) and also research in a wide variety of implementations like distance (Kember *et al.*, 2010), lifelong (Nordin, Embi and Yunus, 2010) or mobile learning (Motiwalla, 2007; Gedik *et al.*, 2012) are available options that might be utilized.

At this point, the idea of finding a way to use technology to bring eLearning to the student instead of trying to attract the student to eLearning was conceived. The vast popularity of social networks and the very important benefits of the equally popular mobile technologies were considered. Consequently, a mobile technology that takes advantage of the popularity of social networks and at the same time utilizes the unique benefits of mobile and other available technologies was considered. The idea was to combine the benefits of all available technologies in a way that could make eLearning activities and content instantly

available everywhere through simple and easy means of interaction. The assumption was that if such technology was made available, it would be able to address and motivate a larger number of eLearning users thus positively affect the current engagement levels.

The methodology followed in this chapter generally follows the first steps²¹ of System's Life Cycle (SLC) waterfall approach based on systems analysis and design methods (Whitten, Bentley and Dittman, 2001). Thus, starting with the Planning step of SLC, current mobile technologies were investigated to identify if there are implementation gaps where a new technology could fit. Towards this aim, a SWOT²² analysis within the context of the current eLearning ecosystem and mobile market was performed. Following the outcomes of the analysis the objectives, requirements and specifications for developing a Mobile application that could contribute to the productivity of current eLearning implementations were described. Based on these, the Mobile TEL (mTEL) theoretical model was designed to offer a new technological solution that would positively contribute to current eLearning implementations.

5.2 Researched productivity of current mobile technologies in learning

Most of the current major eLearning applications are web based, with the exception of the small but increasing in popularity eLearning environments using 3D Virtual Reality worlds like Second Life (Shepherd, 2007). Although they offer a variety of services including constructive learning tools, in both surveys

²¹ Steps of SLC: Planning, Analysis, Design, Development & Testing, Implementation (Whitten, Bentley and Dittman, 2001). In this thesis, the first three steps were followed.

²² S.W.O.T. Analysis: Analysis of the Strengths, Weaknesses, Opportunities and Threats, in this thesis, of the current eLearning ecosystem and the mobile market (Chase, Aquilano and Jacobs, 1998; Perreault and McCarthy, 2002; Pahl, Richter and University of Applied Science Berlin. Fachhochschule für Ökonomie und Management., 2007).

conducted with students and staff, it became evident that the goal to convey information and initiate constructive interactivity among students and staff is difficult to achieve [5, 6]. The surveys indicated that both students and staff use them mostly as course material repositories rather than as tools for constructive learning. That leads to the conclusion that web based eLearning applications have successfully offered all the benefits of digitizing most of the educational bureaucracy (i.e. serving as course document repositories, communicating instructions, deadlines, grades, etc., offering central point of access to policies and institutional procedures) but have not succeeded in increasing the participation of both students and staff. It seems that students and staff need to interact more frequently and promptly for the eLearning activity to become more interesting and enabled. Furthermore, staff need to constantly develop and update eLearning activities. Based on the same published surveys discussed at the previous chapter, eLearning applications are minimally utilized due to lack of technical and pedagogical expertise, lack of time or both. Additionally, the observed inefficient use of email as the sole means of communicating eLearning activity, also acts negatively towards attracting and maintaining a larger audience to eLearning implementations.

Evidence that more and more young people spend more time on absorbing media mostly using mobile devices (Ahuja, 2013). It is only logical that Mobile applications have made their appearance in the Mobile markets. Mobile applications available at the market that are relative to education fall into two categories:

- Mobile access points to existing web based eLearning applications (light mobile versions to access Blackboard, Moodle, etc.), which mainly offer

the ability to access and manage some of the on-line content available by the institutional web-based eLearning application through a mobile device. They are not as advanced or complex as the web based versions, but merely more convenient interfaces for smaller screens and often more efficient from a network bandwidth perspective. As a result, they offer mobility and potential ubiquity, but they carry all the weaknesses of their web-based siblings.

- Utilities which are relevant to education in an indirect way and apply mostly to instructors (like attendance, grading, student portfolio, eBook readers, notes taking, citation utility applications and others). As also referenced in Section 3.3, although some are very convenient, most of them are indirectly or in many cases not related to the process of learning at all.

Despite the fact that mobile devices offer so many advantages and may service students independently of their location and time-zone, there are only very few applications for the sector which basically just offer limited access to the actual web based platform.

A reason would be that mobile devices are not powerful enough compared to desktops or laptops for such applications to be deployed and besides the weaknesses of the web based platforms are yet to be resolved. As García-Peñalvo (García-Peñalvo, Colomo-Palacios and Lytras, 2012) states, “formal and non-formal course-based approaches have not taken full advantage of these new informal learning scenarios and technologies”. If the benefits of web-based eLearning applications with their required infrastructure (servers, databases, etc.) are combined with (1) the benefits of mobile devices, (2) the widely available Internet connectivity, (3) the popularity and growth of social media and

communication systems (messaging, videoconferencing, collaboration systems, etc.) then innovation can be produced that will significantly modernize eLearning to the needs of current learners. So, the solution is to be found in developing an m-learning application that will add value to current web based institutional learning platforms. Web-based platforms will be enriched by the beneficial attributes of mobile technologies such as ubiquity, convenience and interactivity (Turban, King and Lang, 2011). Taking advantage of current popular mobile applications such as social network and mobile communication apps and considering that m-commerce has already familiarized users to the mobile application ecosystem, an mLearning application has good foundations to succeed increasing the number of learners to all types of eLearning activities.

5.3 Current Learning Related Technical Environment Analysis

A SWOT Analysis is appropriate at this point to record current eLearning weaknesses, identify reasons for not taking complete advantage of informal but also formal scenarios and technologies towards learning, seek for opportunities for increasing the effectiveness and efficiency of learning and eventually identify challenges in implementing a solution.

5.3.1 Strengths

- They are digitized repositories of course related materials. Students have a quick, fast, and cost-effective way to access course related materials almost from everywhere (provided that Internet access is available). Apart from that, the following indirect advantages should be considered:
 - Storage reduction cost due to elimination of paperwork,
 - reduction of paper and office consumption costs,
 - reduction of mailing and distribution of documents' cost, etc.

- Utilization of current eLearning platforms to provide interactive multimedia web content to participating users (instructors/students). With the provision of the required technical infrastructure participants may access video-tutorials, pod-casts, webinars, discussion forums, blogs with comments, wikis, simulations, etc. Some of those tools look very promising if they manage to succeed critical participation, that is having enough actively participating learners for the activity to become meaningful and interesting.
- There are technological options that may be used for eLearning, that have a very small or no installation cost while at the same time offer similar or even more features as compared to the expensive commercial ones. More than 40 UK higher education institutes are reported to have some type of constructive activity in Second Life while others use similar platforms such OpenSim²³ (Kirriemuir, 2007). The reason for this is offered by Warburton: *"... it is the relatively low cost of entry, plus the ability to create complex objects and environments, combined with the sophistication of its graphics and the rich immersive experience"* (Bourner, 1997). However, Second Life is not an easy tool to use for eLearning and there are several barriers (Warburton, 2009) that make the application to be much less used compared to web-based LMSs who represent the majority in growing market. *"There is clear evidence of increasing use of LMSs"* Browne reports (Browne, Jenkins and Walker, 2005) which proves their cost effectiveness potential. However, obstacles such as high programming

²³ OpenSim is a powerful and freely available tool for modelling and simulation of movement supported by Stanford University ('See The World', 2016).

expertise, specialization in graphics and physics algorithms²⁴, and also high Internet speeds and client hardware resources limit this option mostly to research and commercial implementations. So alternative cost effective technologies exist, and even the open source ones like Moodle may not require entry costs but still have high maintenance costs. They may offer a more advanced platform for developing learning activities like Second Life, but they do require high technical expertise.

- Finally, the Joint Information Systems Committee (2003), a UK not-for-profit company whose role is to support post-16 and higher education, and research, at their report list the following benefits:
 - Open & wider access to learning
 - Greater efficiency in administration (financial processing of students, etc.)
 - Integration of data across the institution (mostly from an administrative point of view)
 - Other mostly administrative, not related to education or learning.

Although the benefits presented by the JISC report are important, are mostly related to administrative rather than educational benefits. The fact, that they support the dual role of current eLearning platforms that seems to offer the tools to increase administrative efficiency while reducing many costs, is an inevitable parameter that influences the investment on educational technology.

²⁴ Physics algorithms, also referred as “game physics” are software engineering algorithms that are used for game programming and generally 3D rendered environments. They are mostly responsible for computing motion of objects in virtual scene, mechanical interactions and generally the functional operation of objects in a virtual graphical environment (i.e. Second Life world and avatars)

5.3.2 Weaknesses

- Maintenance and other incurring running costs may not be justified if the application partially fails to deliver to its full potential especially if the organization has over relied on TEL. Nevertheless, technology must satisfy Bourner's prediction: "*The range of courses on offer by each institution will be re-engineered in ways that place more emphasis on work that makes a high financial contribution per student and away from work that yields a low contribution*" (Bourner, 1997). Thus, the success of eLearning constructive implementations, is directly related to the financial budget allocated for such projects.
- Requires a certain, merely advanced, technical expertise of behalf of the developer of learning content for any eLearning platform. In addition to that, it requires adequate knowledge of pedagogy and pedagogical implementations in eLearning (*Statistical Bulletin Internet Access - Households and Individuals 2013*, 2013). As JISC puts it to state: "At the University of Wales Institute, Cardiff (UWIC), teachers have to grapple with difficult IT skills which require time and inclination, while at the same time many have limited access to computers, some of which are old and many are shared, which makes formatting and saving learning styles a trial" (Joint Information Systems Committee (JISC) and Universities and Colleges Information Systems Association (UCISA), 2003).
- Requires a significant investment of time on behalf of learning content developers. Since in most cases this role is adopted by instructors, whose time is already consumed by their other duties, the time required to develop an academically effective implementation is never available

(Kirriemuir, 2007). As reported by JISC, “[An academic from the University of Birmingham comments] The time available to staff, necessary to update their skills and experiment with and exploit opportunities provided by the LMS is still a barrier to wider uptake. Maybe more dedicated support is needed” (Joint Information Systems Committee (JISC) and Universities and Colleges Information Systems Association (UCISA), 2003).

- Resistance to change ranges between the 3rd and 15th position in the ranked challenges by UCISA surveys between 2003 and 2010 (Joint Information Systems Committee (JISC) and Universities and Colleges Information Systems Association (UCISA), 2003; Browne, Jenkins and Walker, 2005; Browne *et al.*, 2010). People don’t feel comfortable with changes in their life or work environment. The education sector is no exception to that (Browne, Jenkins and Walker, 2005; Browne *et al.*, 2010).
- It has been observed that students seem not to be motivated enough, especially for formative constructivist implementations of learning. As a result, critical participation mass is not achieved and the learning objectives are not reached (based on the findings of the students’ survey and Blackboard usage data). At the beginning of this thesis, having as a basis theories on constructive eLearning, it was thought that the problem of lack of motivation could be related to the fact that there are too few such implementations. As it is clearly indicated by Browne *et al.* (2010) and in accordance to the Universities and Colleges Information Systems Association (UCISA) reports up to 2010,

the major barriers of TEL development, are lack of money, time and academic staff knowledge. The same three barriers have been identified by the literature review so far and have been confirmed by the surveys conducted at Deree College as well. They all play an important role on the development of such implementations. These barriers seemed to be essentially affecting constructive and generally more modern and more complex eLearning implementations that were though as enablers of motivation for students to increase their participation to eLearning. To furtherly investigate the matter such implementations were developed and offered to students for several academic periods. Based on student responses and complemented by Blackboard usage data, it was interesting to find that although there may be some increase in the motivation of students accessing such implementations, there is still a large number of students that either do not use them at all or do not use them to the extend expected (section 4.2.4 LMS Content Analysis). Moreover, the data analysis did not offer any insight as to whether constructive learning methods are responsible for the occasional usage increase observed in such implementations. Therefore, it can be assumed that more enhanced eLearning implementations mainly in terms of expertise and possibly cost, still do not manage to offer any drastic change to the motivation attitude of students towards the use of eLearning implementations. It has been observed that if the implementation is not related to a summative assessment, then student motivation seems to be much lower indicating that grades are a bigger motivator than any eLearning implementation regardless of its developmental complexity or the

learning theory it follows. Having these in mind it was deductively acknowledged that further development towards the enhancement of current platforms will probably have a little effect to the increase of student engagement. At the same time, such solutions have already found to be very complex and costly to be developed within the context of this thesis.

5.3.3 Opportunities

It seems obvious that one way to balance the equation with respect to TEL success is finding a way to reduce as many weaknesses as possible of the current related technology as indicated by the analysis so far.

Academic institutions, either public or private, are complex service organizations. They are supposed to offer learning services for a certain cost, which they have to compensate with certain revenue that will eventually provide enough profit for future investment growth, research, security, etc. Essentially, a similar approach is followed like other non-educational businesses in the market, although the educational market segment is considered more sensitive and more strategic.

There are basically five Competitive Strategies in businesses: Cost Leadership, Differentiation, Innovation, Growth, and Alliance (O'Brien and Marakas, 2010).

Based on the weaknesses section of this SWOT Analysis, the running costs of eLearning implementations are justifiable, provided that the TEL meets its learning objectives. By improving this sector, it would satisfy the cost leadership strategy, indicating an opportunity.

Having excluded further development on current eLearning platforms, the focus turned on the outcomes of other areas of the literature review. The findings of

Chapter 3, assisted in identifying that most people (including students and instructors) spend a considerable amount of their time in interacting with social networks. The use of mobile devices not only have increased the time spend on social networks but also offered a continuous awareness of online social activities. It seems that social networks through the ubiquitous accessibility offered by mobile devices are the default online ecosystem for most people while eLearning platforms are one of the many other ecosystems that some users may possibly visit. The utilization for education purposes, of the successful social media ecosystem seems to present an important opportunity. Furthermore, considering the increasing interest in distance learning, there is a higher demand for finding solutions that would make learning available or at least accessible without time and geographic restrictions.

Considering the above deductive thinking, Mobile TEL, attempts to reduce weaknesses of current eLearning implementations taking into consideration and using all current learning or non-learning technologies, towards bringing the benefits of eLearning closer to a larger number of people.

Increasing the numbers and participation of learners through cost efficient eLearning solutions would additionally provide a differentiation and innovation advantage when compared with current implementations of eLearning technologies. In the following sections, it will be exhibited that one of the core functions of Mobile TEL, the “notification system” that uses, among other means, social networks to notify the user, is dedicated to increase the up datedness of the learning community, using the user’s “natural” mobile habitat (usually social networks), resulting to an increase of their interaction with the deployed eLearning activities.

What remains to be answered is what causes failure of full achievement of TEL objectives? Based on the weaknesses section of the analysis, (1) lack of technical expertise and (2) insufficient time of instructors constitute two of the main reasons. According to the specifications section of the Mobile TEL theoretical model the voice command system of mobile devices is utilized to simplify the access and maintenance of learning content facilitating at the same time Mobile TEL users to perform such actions in parallel with other tasks (i.e. respond to a communication while driving). This economizes time to maintain TEL content and increases interaction with the participants by also providing personalized, all-in-one access through all possible communication channels (including social networks), between students and instructors. Furthermore, the resistance to change weakness is also dealt, since Mobile TEL offers most of its benefits through already existing, commonly and daily used popular technologies. The technologies are available for mobile devices due to an already established handset culture for mobile devices (Turban, King and Lang, 2011).

Another major weakness that may be addressed by the Mobile TEL Application would be the challenge to motivate students in getting involved. The problem originates from the fact that since students are quite indifferent about what is going on at the web based eLearning application, they do not receive updates about on-going activities deployed there. The more they stay outdated, the more they become demotivated to get involved with on-line activities in progress. As a result, such activities fail to serve their purpose. The innovation that the Mobile TEL offers through its specifications (see Section 5.4.2), is that instructors will be able to notify their students through their preferred platform (i.e. Facebook) which they most frequently visit for personal reasons, no matter what. Moreover,

offering multiple simultaneous channels of communication such as email, SMS/MMS, Social Media, etc., the possibility that student will not be notified is minimized and therefore the possibility of engaging in an eLearning activity is increased. This satisfies the Innovation Strategy.

Finally, considering that there is no application that offers these specifications well aligned with both benefits and weaknesses of eLearning applications, makes Mobile TEL unique in the market of TEL satisfying both the Innovation and Differentiation Strategy.

Mobile TEL is an opportunity. It satisfies all Competitive Strategies except of the Alliance strategy opening a new future with respect to the commercial value of eLearning. As Molly Corbett Broad, - president of the American Council on Education states at the Chronicle of higher education - mentions, the excitement of the eLearning technologies potential is a combination of the expansion of access and the reduction of cost (Young, 2011) which is one major determinant of the commercial value of eLearning.

5.3.4 Threats

Current TEL applications, based on their weaknesses, hide one but very malicious and dangerous threat: The implementation of a TEL system that would fail to meet its objectives. Consequently, its running costs would become a financial wound to the institution that may become very significant in the case that the chosen platform is a commercial one. As research has shown, web-based eLearning platforms are mostly used as on-line repositories rather than facilitating learning. Consequently, their major objective mostly fails to meet its purpose.

5.3.5 Research Objectives based on the SWOT Analysis

The aim of the thesis is to provide a novel solution that will assist in the increase of participation and possibly engagement of students and instructors with current eLearning platforms by reducing their weaknesses and enhancing their benefits at an acceptable cost.

Based on the above SWOT analysis, the solution seems to lay in developing a new technology that will mostly use existing technologies including, but not limited to, current eLearning implementations, so that their weaknesses are compensated without making current investments to these technologies obsolete. Hence, the new technology would take advantage of the infrastructure offered by the currently implemented technologies (existing institutional eLearning platforms and other web-based services) and enhance it by acting as a disseminator of delivering the appropriate content format of various eLearning activities to become accessible by multiple on-line services and communication systems. That means up datedness and access utilizing available technologies without time and geographic restrictions.

To summarize, the following major areas were used as a foundation for building a theoretical mobile Learning application:

- Capitalize upon prior knowledge and experience of popular application platforms.
- Modification of resources and systems to permit user interaction across a wider range of resources mostly in an automated fashion.
- Enable a multi-platform communications system to enable learners and teachers to interact and collaborate thus increasing engagement of both.

- Provide the means to increase the size, access and participation of the learning community without requiring in-depth technical knowledge.
- Provide the means for keeping the learning community timely updated to any learning activity occurring in any web-based eLearning platform or other service used by the instructor.
- Utilize all the above in a cost-effective platform both in terms of acquisition and in terms of maintenance.

5.4 Application Objectives, Requirements, Specifications and Design

Based on the two surveys conducted separately on staff and students, students, in their daily habits, seem to rarely, if at all, include the monitoring of eLearning content and activities provided by Higher Education TEL web-based platforms. In addition to that, academic staff, being overwhelmed by their numerous duties but also due to technical background deficiencies that are often required to develop interactive eLearning activities, fail to respond to the level required to achieve student productivity via eLearning applications. Furthermore, and based on the same reasons, instructors that manage to implement eLearning activities also fail to monitor the eLearning activities deployed as actively as required. It has also been observed that there is little evidence suggesting that engagement is related to the type of tool or activity implemented while complex activities require more time from instructors. Considering the SWOT analysis it was concluded that most TEL potential users are highly engaged with social networks staying constantly “connected” via mobile applications.

Mobile TEL attempts to approach the problem in an opposite way compared to existing implementations. Instead of expecting students and staff to come closer

to TEL applications, it brings TEL closer to them by providing a mobile interface and the means to interact through it. This interface, utilizes existing modern and popular communication methods through one single application that will be responsible to disseminate content in a synchronized fashion via all communication channels, thus increasing the probability that all involved parties will receive and respond to notifications and activities promptly. In that way, the main objectives that have to be met in order to increase engagement of the learning community (staff and students) should be the following:

5.4.1 Mobile TEL Objectives

Within the context that Mobile Learning, by making information and communication available in ubiquitous personalized form (Huang, 2009) Mobile TEL offers the following objectives:

- To be able to receive communications and content from a variety of on line sources, web and mobile in real-time. The idea is to increase the effectiveness of notifications that update the user (student or instructor) in more ways than the ones offered by default by institutional learning platforms (for most LMSs the way to notify users is through their in-app notification system and/or via email). mTEL should be capable to offer these notifications using web services and other mobile applications to reproduce those notifications via a variety of mobile services some of which are very popular among users. That way mTEL increases the probability that users will eventually see them and possibly act on them thus increasing the number of users' access and potentially their engagement to existing institutional LMS.

- To be able to disseminate communications and content to a variety of online sources, web and mobile in real-time. Thus, users of mTEL who wish to address such communications will be able to do so, directly from within mTEL without having to access the application that originally produced the notification or the institutional LMS. That way, responding or reacting to notifications becomes much simpler and faster. At the same time, it addresses the challenges currently related to the time and easiness required to interact with LMS activities that are also relevant with the users' engagement with eLearning platforms.
- To be able to share content to a variety of available devices and communication methods (i.e. other computers, smartphones, TVs, projectors, etc. or via Wi-Fi, Bluetooth, NFC, Android Beam, etc.). Additionally, to automatically choose the most appropriate available content format, with respect to connection quality of the device finally used to deliver the content to the user. This objective aims to provide additional convenience for LMS users that although they are motivated to respond to an eLearning activity or notification, they postpone it. This may happen because at the time the activity occurs, their mobile device is not the most suitable tool to do so (for example small screens of mobile devices are not convenient to access or interact with some activities). So, user reactions to eLearning activities, which because of such inconveniences are currently left to be addressed later by the user and possibly be forgotten or neglected, can now be addressed on time, using other cooperating devices such as a Smart TV. With Smart TV being only an example, mTEL is able to share content with a variety of devices. This offers the

convenience for its users to virtually have eLearning in their pocket in most places they may be, also taking advantage of any additional options provided by the shared devices (like sharing content to an audience using a projector as a sharing device). However, not all online content made available in learning is offered at an appropriate format for cooperating devices and communication methods, Thus, mTEL should incorporate the ability to choose the most appropriate content available that aligns with the cooperating technologies that will be used.

- To offer the user with the ability to choose the appropriate available content based on their needs (i.e. if the same content is available on text, audio, video, subtitled video or sign language video or multiple languages). In cases that the content is available in various formats, the mTEL user should be offered with the choice to select the most suitable one for their needs. This feature may additionally increase the number of users since, provided there is content that may address hearing challenged people or people speaking different languages.
- To provide access through either the graphical user interface or a voice driven interface depending on the users' needs always using existing popular already installed mobile applications. That way, users who could not promptly respond to updates because they are engaged with other activities or are physically challenged (i.e. driving users or people with sight problems) may switch between the graphical user interface to the voice command and voice-to-text interface to instantly react instead of postponing their action. That also decreases the time put to eLearning activities and offers additional options that may reduce barriers for some

categories of physically challenged people thus potentially increasing the number of participants in eLearning activities.

- To harness the functionality and capability of existing hardware and services to minimize the footprint of the resulting Mobile TEL app (thus providing quicker time to market, lower cost, lower complexity and reduced overhead). mTEL is designed mostly using and cobining existing available technologies. That way, users, address eLearning activities using the familiar interfaces of applications already installed in their devices. That makes the use of mTEL an easy task and reduces barriers resulting from lack of expertise and training. At the same time, development and software update time and cost, are highly reduced while mTEL becomes a low energy and resource consuming application. This is a benefit that may potentially make it available to a broader variety of devices and users without bringing into the scene any high cost challenges both for institutions and its users.

To summarize, the approach places Mobile TEL application in a central position between applications, learners and staff already use (social networks, messengers, telephony, streaming, etc.) including eLearning application activities and content, thus creating a learning community that is not bounded by any technology, media, location, content or time. Hence, learning activities are not anymore restricted to be performed only within eLearning applications on the web, but are made available through all popular technologies people already use

as described in Figure 48. The detailed operation of the mTEL model will be described with use-case examples at the following sections.

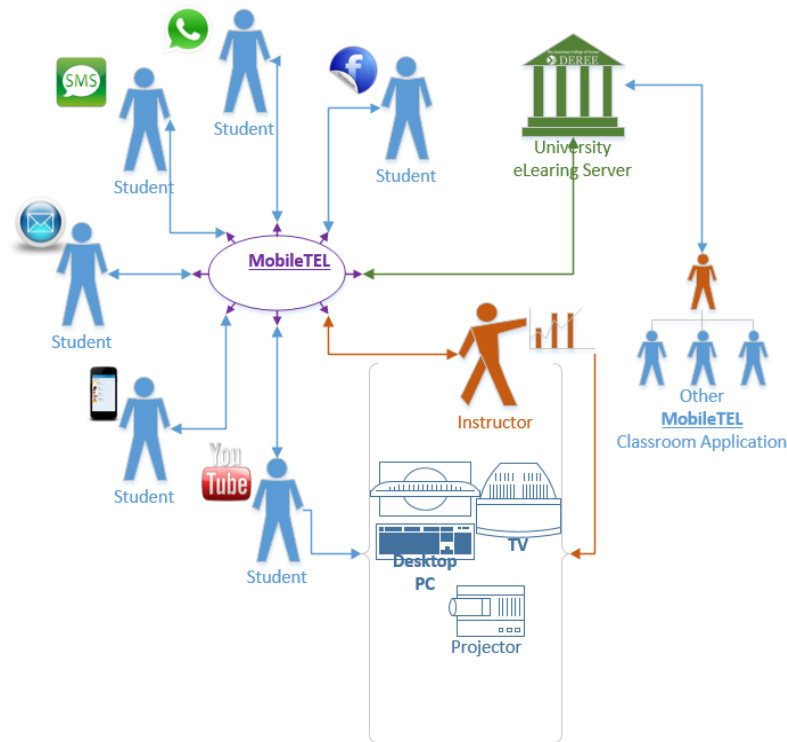


Figure 48: Mobile TEL UML Diagram

5.4.2 Specifications

In this section, a detailed list of the theoretical Mobile TEL application is presented.

1. Multiple User Login: Every user of the Mobile TEL app needs to be identified. Identification plays a very important role since it is required to assign the right user to the right institution and related content areas but also the right role in the application (student, instructor). In addition, it is required so that the appropriate credentials are sent to all already setup cooperating applications (like Facebook, Viber Messenger, email, etc. apart from cell phone services like calls or SMS, which are coordinated through the device's SIM card). (See Figure 48)

2. Graphical User Interface: The Mobile TEL is mainly using already, installed mobile applications and services like Facebook Messenger, email, SMS, etc. Therefore, in terms of GUI, the requirements are minimal through one main screen that covers the following options:
 - a. Notifications button which provides access to a notifications list from all setup mobile applications and services.
 - b. Setup button which provides access to a menu of options to setup Mobile TEL connectivity with the existing applications and services available to the users.
 - c. An on/off button which enables or disables the voice command system.

For that reason Mobile TEL's GUI mostly relies on Android Design Principles (Google, 2014) although Apple's recorded guide for iOS designing (*Designing for iOS*, 2015) was also considered. Following these guides, it was found that there are only very limited number of ways for designing the user interface. Additionally, empirical observation of popular mobile apps was considered²⁵. The resulting UI was made to mostly follow popular mobile apps' interfaces; users are already familiar with. For example, the settings button leads to a settings menu which is similar to the one used by Facebook, Google Mail or Viber.

3. A content sharing system, capable of sharing content using common wireless communication methods already available for mobile devices such as Wi-Fi, Bluetooth, NFC, Android Beam, etc. Provision should be

²⁵ Based on total downloads (millions) the top 5 apps are 1. Messenger 59.7M, 2. Snapchat 54.5M, 3. Facebook 45.8M, 4. Instagram 40.4M, 5. Color Switch 39.0M (McAlone, 2016) all social networks. Since such apps are so much preferred among the downloads of users it seems logical to assume that the users have recognised benefits in the areas of service and usability combined.

made to forward content at appropriate to the forwarding communication method quality and size. For example, receiving streaming video accessed by your mobile phone through Wi-Fi, in order to transmit it to a laptop via Bluetooth at real-time. (please see Use-Case example - Mobile Virtual Classroom section 5.4.4)

4. A mobile Virtual Class system that enables the instructor to disseminate content to a group of students who are all using the Mobile TEL at a pre-scheduled time. Details and design diagrams may be found at (Use-Case example - Mobile Virtual Classroom, section 5.4.4).
5. Ability to initiate on-line activities using the institutional eLearning application web page, while communicating and disseminating (where possible) bidirectional information and assets either directly through Mobile TEL or using any of the popular commonly used on-line and mobile services. For example, the instructor places a certain question on the Blackboard (Bb) LMS Discussion Board. Traditionally, Bb will send an email to all subscribed users of that forum. However, if Mobile TEL is used, then the message will be transmitted by all currently Mobile TEL configured methods, like a post at the course's Facebook (Fb) Page timeline, a Fb private message, an email, an SMS or a Viber message. In that way, the opportunity of increasing the participation and engagement of students is considerably amplified by increasing the awareness level of the notification. Based on the same logic, students may respond with the same benefits and promptness and soon enough there may be a critical mass for an asynchronous conversation to begin without the constraints of place, time, and physical contact. Moreover, this example exhibits a constructivist approach in learning (Nordin, Embi and Yunus, 2010) since

learning is acquired through group effort and enhanced by community support by peers, instructors or even invited subject experts. Thus, it may be concluded that mTEL is equally capable of handling the usually more complex constructive activities as well as the simpler positivistic contents. mTEL notification system attempts to increase the participation of the community by increasing the prompt awareness on all types of learning activities primarily happening on current institutional eLearning implementations or any other online connected service. Although awareness does not guaranty engagement, it is better than non-aware users thus it can safely be concluded that it is an important step in the right direction.

6. The application should be able to receive and provide notifications from all connected platforms and technologies in one single place. Additionally, not only it will provide the functionality of accessing and responding to the related content but also create and push new content to any connected platform from within the application hence supporting the specifications 4 and 5 (Figure 48). Additionally, a central place for notifications from all connected sources, makes it easier for the user to find new and older notifications and revise the workflow of the activity especially in a blended eLearning environment (example: an activity that combines LMS with Social Media).
7. Voice-to-text Interface and Voice-Commands Recognition: Voice commands recognition system and voice-to-text conversion will provide the convenience of being able to use the application at hands-free mode, possibly while the users' hands are occupied with something else like driving. This will also provide convenience for several categories of

disabled people which may interact with the application without physical contact with the device. Additionally, a context awareness feature might be added to the initial design making the application being aware to a certain level of its usage situation (Häkkinen and Mäntylä, 2006). Thus, Mobile TEL may automatically turn on the Voice Command system if the accelerometer sensor of the device indicates that the speed of movement is that expected of a car and therefore the user is driving.

8. Synchronization: Mobile TEL will be able to connect to all cooperating applications (e.g. Facebook, Blackboard, email, Viber, etc.) when any interaction occurs (such as an assignment post or a question or announcement and generally any content). The Mobile TEL will be able to retrieve information not only about new content relative to its activities or to the connected eLearning application but also push content to both students and cooperating applications so they all are all in the same page and promptly notified. Then action may be carried within the Mobile TEL environment, or by invoking the sending application on the user's phone (i.e. Facebook Pages Manager) where possible (Specification 9). Synchronization keeps Mobile TEL users updated to the current eLearning content and activities and motivates them to take on eLearning related activities thus initiating interactivity. In fact, this is the main characteristic of constructive learning (Figure 48).
9. Finally, transition to the related to content third party service (i.e. Blackboard or Facebook or others) will be offered for the user, in case he wants to directly interact from within the native application.

5.4.3 Mobile TEL Architecture

The Mobile TEL high level architecture is graphically demonstrated by the following diagram:

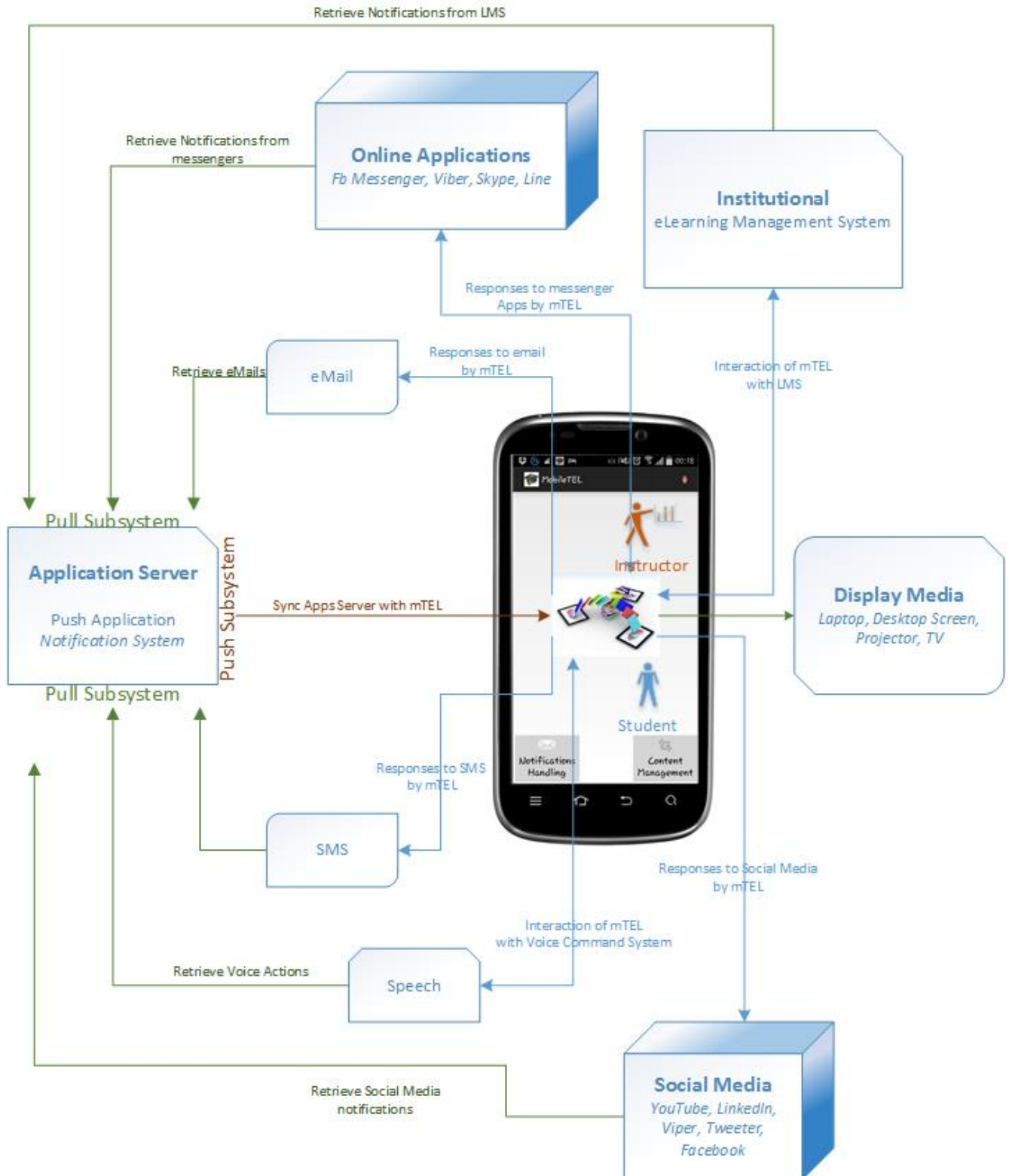


Figure 49: Architectural Diagram

Figure 49 shows a web/cloud based application server that constantly connects to all available communication and network services and pulls available activity updates. When updates occur, they are pushed by the web server to mTEL which disseminates them to its users using all available phone and network services.

Based on the architectural diagram (Figure 49) the Mobile TEL consists of two applications.

The main Mobile application is installed on the mobile device(s) of the member of the learning community. An auxiliary application is installed on an application server, which is responsible for the synchronization of the Mobile TEL.

These components are referenced in detail in the following sections:

Mobile TEL (Main Mobile Application)

The Mobile TEL application is installed on mobile devices of the members of the learning community. Its purpose is to increase the prompt awareness of the members of the learning community to any learning, or related, activity occurring at the web-based eLearning Platform. Additionally, mTEL offers a direct access and response system that utilizes a variety of options that reduce the time spend and the technological expertise required to access appropriate content. Such access is achieved using the most suitable available device and is independent of any time and/or place barriers. Consequently, not only due to more awareness but also more opportunity towards immediate access and prompt response, it is logical to assume that the probability of more engaged users will be increased.

To do so, the Mobile TEL application model takes advantage of the benefits of existing technologies in an effort to design an application that provides real-time mobile interactivity, at the places where both learners and instructors are. No

consideration of their physical (geographic) location takes place, but instead, additional consideration is taken of the cyber-location to which they mostly spend their time. For example students spend time in Facebook as part of their daily routine (Pempek, Yermolayeva and Calvert, 2009) but may never enter their course web site unless material for a closing summative assessment deadline is required. Additionally, according to Pempek (2009), “*Students communicated on Facebook using a one-to-many style, in which they were the creators disseminating content to their friends*”. Furthermore, a study on teens up to the age of 18 (Ahuja, 2013) showed that they spend more than 7.5 hours a day on mobile devices consuming media like social networking, listening to music, surfing the web, playing, etc. Junco (2013) reports in his survey, that students responded that they spend an average of 149 minutes per day on Facebook. As it was found, students had significantly overestimated this from the actual 26 minutes per day. This can be explained by the fact that Mobile apps (like Facebook) allow the users to be constantly logged in. As a result, although they may not be actually browsing Facebook pages or actually using the Facebook app, they are considered as using Facebook much more than that, since they frequently receive and respond to its notifications. Hence, although they are just using Facebook for 26 minutes per day, they are engaged to it for 149! Considering that this study refers only to Facebook, it logical to assume that the time students are engaged to mobile applications services is much higher.

Evidently, students do everything they would optimally be expected to do using an eLearning application, but with non-educational content in Facebook. Hence, it is safe to say that they already have the technological background required for using an eLearning application since they are of similar or simpler complexity.

Additionally, if eLearning content and activities finds their way into social networks, it might motivate some their users to access them as just because they were notified there. The idea is to enrich the current popular online environment of users (e.g. spending time in Social Networks, socially texting or using SMS), with learning activities, not only through the same media and applications but also other popular communication technologies. An example of this (see Figure 50), would be a course related content like an announcement or a forum post to be shared to the corresponding to the course Facebook page and therefore generate a notification for the members of this page (students taking the course) using the notification system of Facebook.

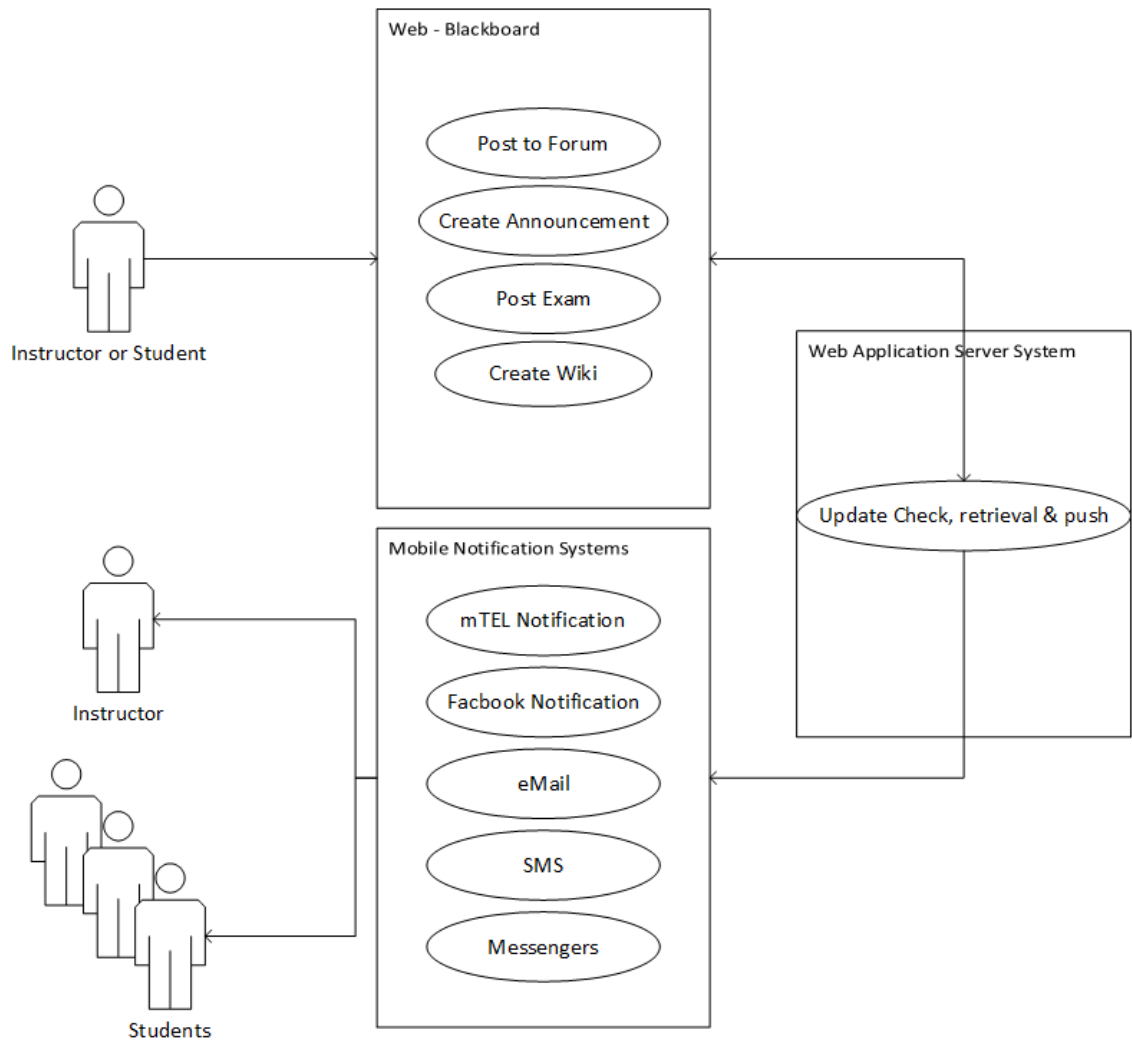


Figure 50: UML Forum, etc. post example Use Case Diagram

That way, students that receive and view Facebook notifications for social reasons anyhow, will also be “forced” to at least see course related notifications as well. Such notifications, otherwise, would only be made available through the institutional eLearning platform notification system, which they rarely see even during the few times that they access it. Additionally, based on the user preference, the same announcement created at the eLearning platform may be made available through SMS, email or mobile messenger apps which produce notifications at the phone’s status bar, including Mobile TEL, making certain that the message is conveyed to the members of the learning community.

The Mobile TEL Application Theoretical Model offers the specifications and the conceptual and contextual design for developing a mobile application. Such application that takes advantage of existing web and mobile technologies and user/student behavior. It also approaches eLearning for a new perspective that may shift a large number of students into investing the time they already spent in mainstream Internet applications, to learning activities.

The Mobile TEL achieves this with the assistance of the auxiliary application that is constantly updated by any learning activity that is communicated not only at the web-based learning platform (and usually announced only by email), but also through any application or service connected to the Mobile TEL, and operating at the user's mobile device (Figure 50). It is also responsible to disseminate any learning activity communicated by any means, to all connected applications. That achieves real time updating with respect to any learning activity via all connected services. For example, an instructor creates a wiki at the web-based platform (i.e. Blackboard). Blackboard will generate an on-line announcement at its announcement system and a notification at the native notification system. The only way that the student has to be updated about this, is to visit Blackboard. But, as it has already been established, students mostly prefer to spend their on-line time in other more popular places like Facebook. Because of that, their Facebook Mobile app will notify them for any update occurring in. Most popular mobile applications also work like this; hence a similar behavior is expected. One of the major Mobile TEL innovations is that, Mobile TEL monitors at real-time (through the auxiliary server-side application) all connected services and eventually Blackboard that is used in our example. Mobile TEL will replicate Blackboard's notification about the creation of a learning activity (e.g. a wiki) to all connected

services including popular ones like Facebook. In the case of the Facebook example, the notification may be created as a status update at the Facebook page corresponding to the course for which the wiki was created. As a consequence, Facebook will create a notification and place it at the newsfeed. Similarly, the eLearning notification will be replicated to all existing services of the user's mobile device including Mobile TEL itself. The user might never even come close to a desktop computer to access Blackboard, may ignore the Blackboard notification, may check infrequently his email, and may even ignore the Mobile TEL notification but will definitely check Facebook and/or other services he uses for social reason to also find the wiki notification there. Since Mobile TEL does all that at the background, it can be technically but also literally characterized as a "Ghost" application. Moreover, it delivers these services via mobile devices at any place the user may be, without geographic restrictions or technical restrictions apart from the necessity for an Internet connected mobile device.

Further to this, the Mobile TEL offers a notification center, where all related to learning notifications are gathered in one place. The user may use the Mobile TEL notification center to take any action required for any selected notification by invoking the application that has generated the notification.

For example (see Figure 51), a student may start the wiki content by clicking on the link provided by the notification via Facebook to invoke Blackboard Mobile editor or, respond to a course announcement status by invoking Facebook Mobile or Facebook Pages Mobile app to comment on the corresponding Facebook page status. Based on the architectural diagram, all outgoing communications are forwarded to the most appropriate application that has generated them. For a notification that has been received from multiple places, it is left to the user to

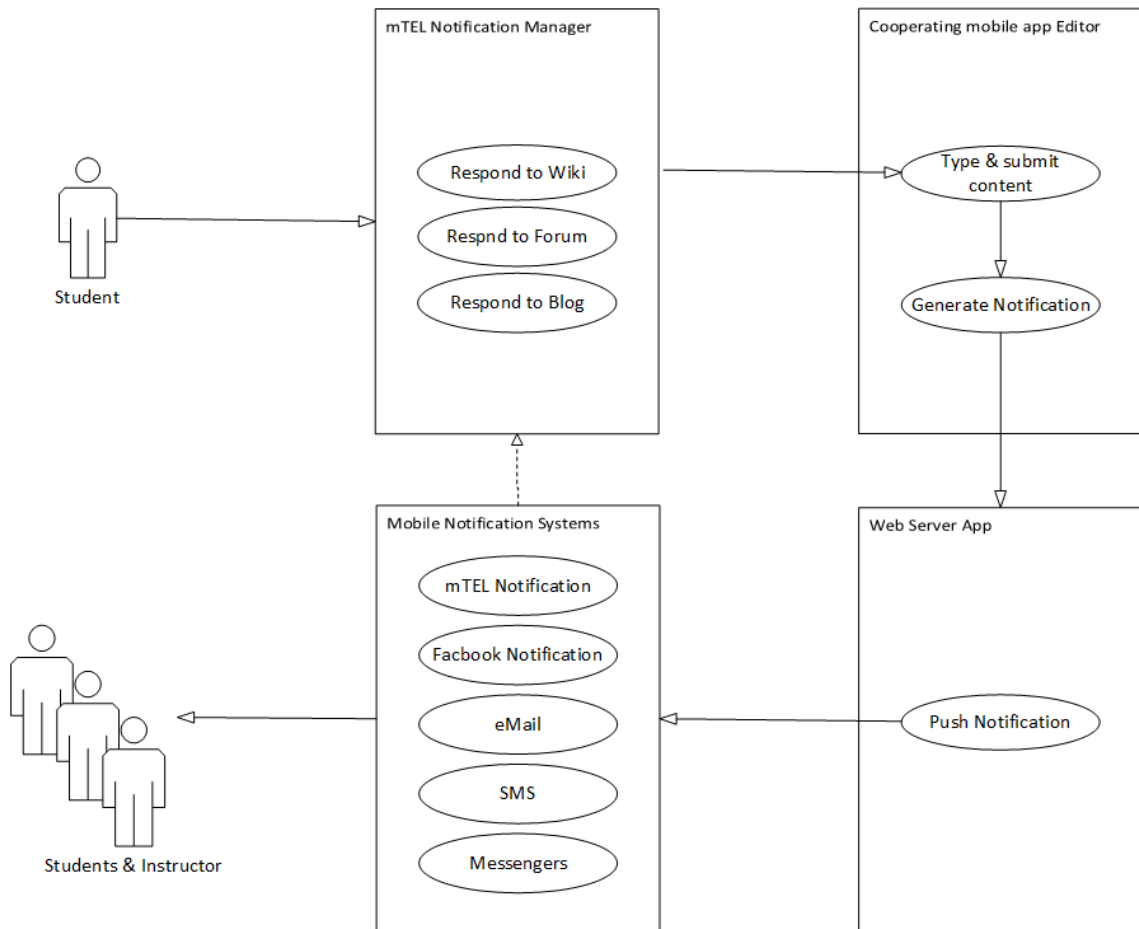


Figure 51: Invoking cooperating apps UML Use Case Diagram

choose the method and corresponding mobile application to be used. The innovation here is that the Mobile TEL, uses existing popular technologies that are already installed at the mobile device of most users, instead of having these functions build-in. This eliminates the burden of development but also maintenance, since most of that, is taken care of the invoked 3rd party applications and not Mobile TEL.

In addition to that (see Figure 52), Mobile TEL offers all described functionality also via the voice command driven system offered by the user's mobile device (e.g. Siri, Google Now, etc.). This enables the user to access Mobile TEL hands free thus enabling them to engage with the learning community at parallel with other tasks they may be doing. For example, an instructor responds to status comment related to a coursework by commanding and dictating to Mobile TEL

verbally, while driving. Also, people that have difficulties with typing may find this the only way to use the learning technology.

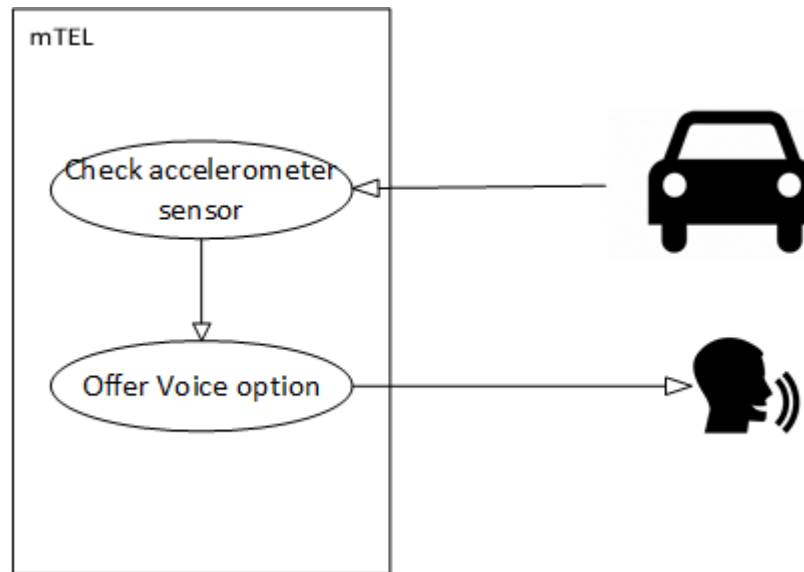


Figure 52: Voice System invocation UML Use Case Diagram

Finally, Mobile TEL will be able to disseminate any content streamed or received to the most appropriate format with respect to the communication quality available at any time. Again, this is a service that relies on existing, available services offered by mobile devices like Miracast (Android) and Airplay (iOS) or Bluetooth connectivity, etc. This permits a small, non-convenient device like a smartphone, to see content (like streaming video) and disseminate it to other available devices to the area like a Microsoft Surface or just a smart TV to display the content (see Figure 48). Should the content be available in multiple formats, Mobile TEL implements technology to disseminate the one most suitable based on the communication quality (Figure 53). More technical details for this function can be found at the Automatic Content Selection in the 5.4.5 Technical Considerations Section below.

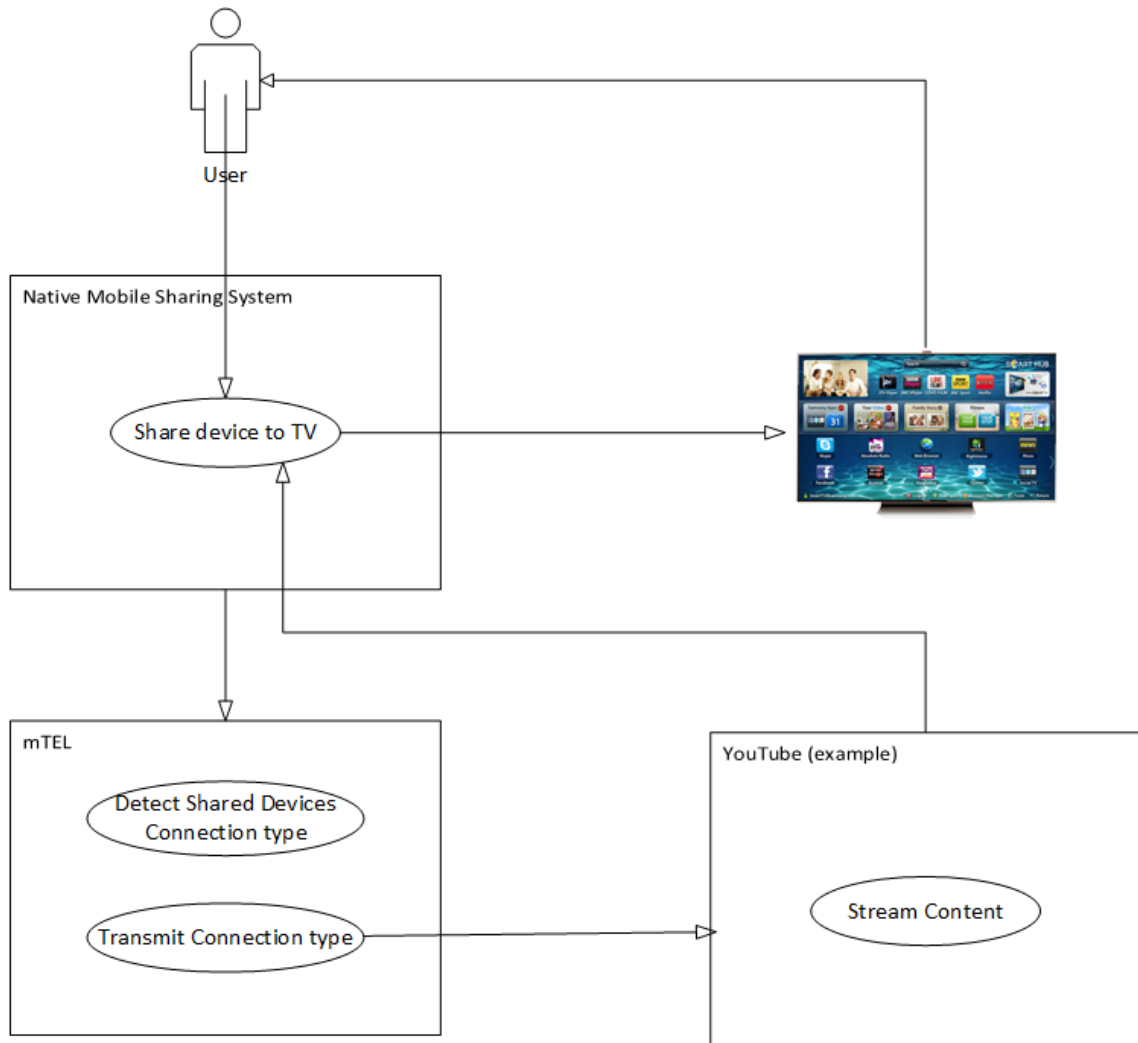


Figure 53: Choosing the right streaming quality UML Use Case Diagram

Sync TEL Auxiliary Application (Server Side)

The auxiliary server side application acts as a distant synchronization service which checks all connected to the Mobile TEL services for any activity related to learning content. For convenience, the name Sync TEL will be used from now on to identify it. This is done in frequent intervals at an application server and not at the Mobile TEL so that no extra mobile resources are used that could deplete the battery or cost carrier charges by producing unnecessary data traffic. Once any new activity is found, it is received by Sync TEL and is forwarded to the Mobile TEL, updating the mobile device's notification bar and page and Mobile

TEL's notification system keeping the user's mobile device always updated to the latest learning related activities.

5.4.4 Mobile TEL Decomposed Architecture

To further assist in understanding the technologies and data flows utilized for mTEL to achieve its goals, a decomposed architectural diagram is presented in Figure 54. As depicted in Figure 50, mTEL requires the mobile software modules and additional server-side software modules. These two sets of modules are responsible for the communication and the flow of data among them but also between the various third-party services and applications used by mTEL to achieve its purpose. In this section, the operation along with the data flows and interactions of those modules will be presented based on the decomposed diagram in Figure 54.

5. E-LEARNING MOBILE TEL APPLICATION: SPECIFICATIONS, ANALYSIS & DESIGN A OF A THEORETICAL PROTOTYPE MODEL

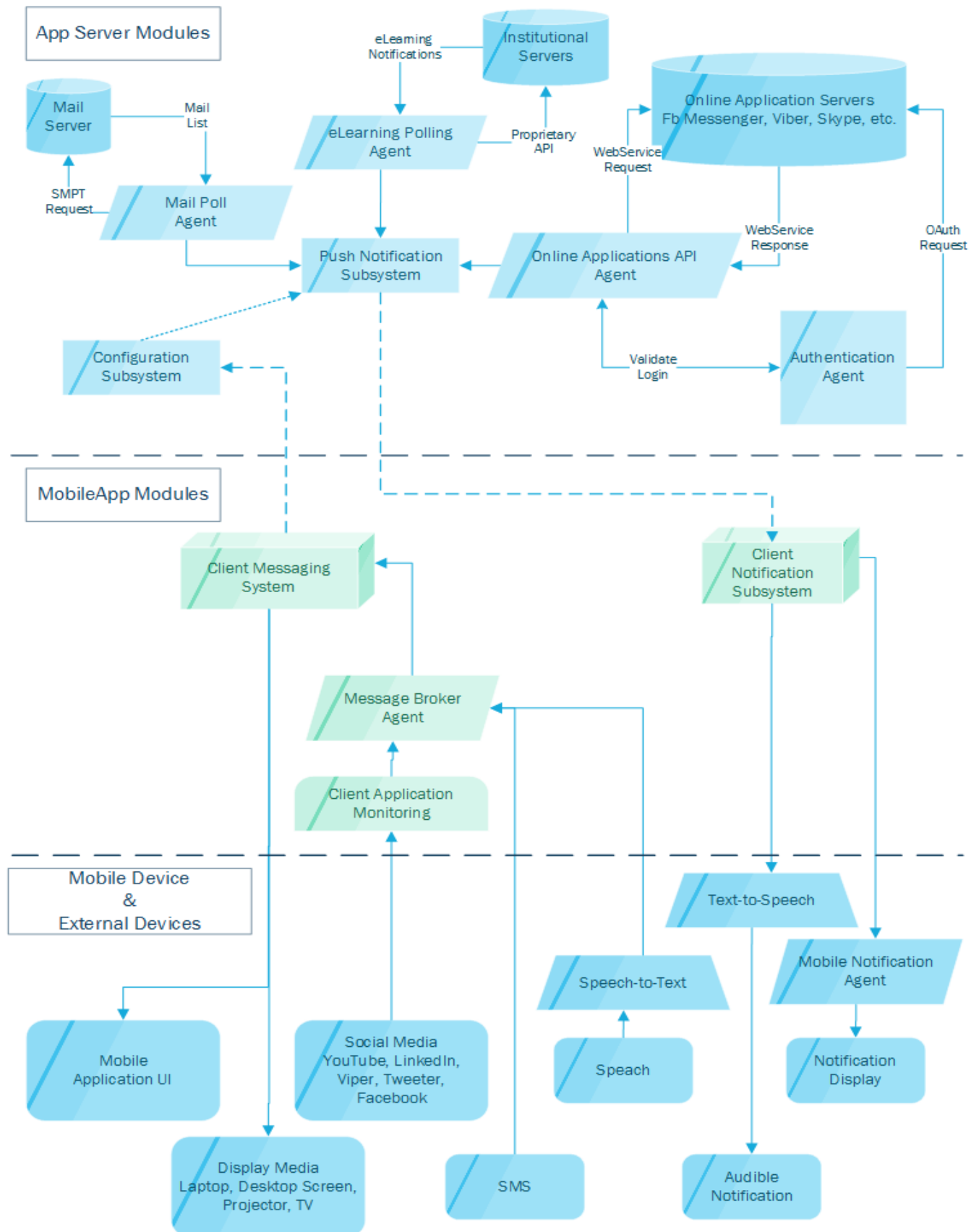


Figure 54: Mobile TEL decomposed architecture

Application Server modules

The Push notification subsystem refers to the core software module that is installed on the online application server. As it was already discussed, the role of this software is to check all cooperating services for updates and push all related notifications to the mTEL notification system. For this to be achieved additional software needs to be utilized. That software refers to a Mail Poll Agent an eLearning Poll agent and the Online Application APIs²⁶ agent for the cooperating applications (i.e. Facebook Messenger, Viber, Skype, etc.). Institutional platforms (Institutional Servers) may require a Proprietary API to be licensed (in case of commercial LMSs like Blackboard). Alternatively, the corresponding web services are freely available to be used with Open Source LMSs (i.e. Moodle, similarly to the Online Applications API). At the same time, most “public” application servers (Facebook, Google Plus, etc.), propose the usage of APIs (web services) that are mostly Open Source and are promoted by the developing company (i.e. Facebook) for third party developers to use.

The Mail Poll Agent is the software that is responsible to check through an SMTP Request if there are new emails at the corresponding Mail Server as depicted by the configurations subsystem settings. The frequency by which the Mail Poll Agent places these requests is also determined by the configuration subsystem. The outcome of this request will be a mail list if there are messages pending on the corresponding mail server. If such list is made available, then the Push Notification Subsystem will transfer it to the corresponding client notification

²⁶ Application Program Interface (API) refers to software such as tools, routines and protocols that are used to build software applications responsible for the communication and the interactions between different types of software. For example, the Graph API is the programming tool that is required to be used in order for an application to connect and interact with Facebook (Facebook, 2014). An example of its most frequent use refers to web sites that offer Facebook login.

subsystem (mTEL module) which will be discussed next at the Mobile Application Modules section.

Using a web service (in case of an Open Source eLearning Platform, i.e. Moodle) or a proprietary API (in case of a commercial eLearning Platform, i.e. Blackboard) the eLearning Polling Agent accesses the institutional LMS and retrieves any notifications pushed through the Push Notification Subsystem at the client mTEL application in the user's device.

Similarly, the Online Applications API agent will use an authentication agent software to produce an OAuth²⁷ request to access the cooperating web services (i.e. Facebook Login). Once connection is established (required once) then a web service request is sent to the cooperating web services (i.e. Facebook messenger, etc.) to retrieve any new relevant notifications. These notifications are delivered via a web service response to the Online Applications API agent which then delivers them to the Push Notification Subsystem so they are pushed to the client mTEL application in the user's device.

MobileApp (mTEL) Modules

The client messaging system is the software responsible to receive incoming communications from the corresponding mobile devices services. The Text-to-Speech mobile native service will be used to convert the received notification to a voice message that will be used to produce an audible notification. The native mobile notification agent will be used to produce a notification display at the native device's notification status bar.

²⁷ Based on oauth.net site: "The OAuth 2.0 authorization framework enables a third-party application to obtain limited access to an HTTP service" (OAuth, 2015).

The client messaging system is the client software also used by mTEL to disseminate any notifications and/or content that is made available by the push notification subsystem. Depending on the content, the client messaging system will select the appropriate user installed cooperating mobile application or mobile service (Mobile Application UI or Sharing Service) to display the content at the phone or connected display media (Desktop Screen, Projector, TV, etc.). Thus, if for example the content refers to a YouTube video, the user may select to view it on the mobile device screen using the default installed mobile application (i.e. the YouTube app) or share it to a Smart TV using the mobile device's sharing service.

A message broker agent is also part of the client mTEL application. This agent acts as a "listener" and is based on a callback subroutine that handles the inputs received by the various cooperating mobile services and social media through the client application monitoring system. For example, if a user decides to respond to an mTEL notification generated by Facebook messenger then the client application monitoring system will detect it and forward it to the client messaging system. The client messaging service will invoke the mobile Facebook messenger application installed at the user's device for the user to respond.

5.4.5 Technical Considerations

This section is dedicated to a detailed description of the technological features that are recommended to facilitate the objectives of the Mobile TEL.

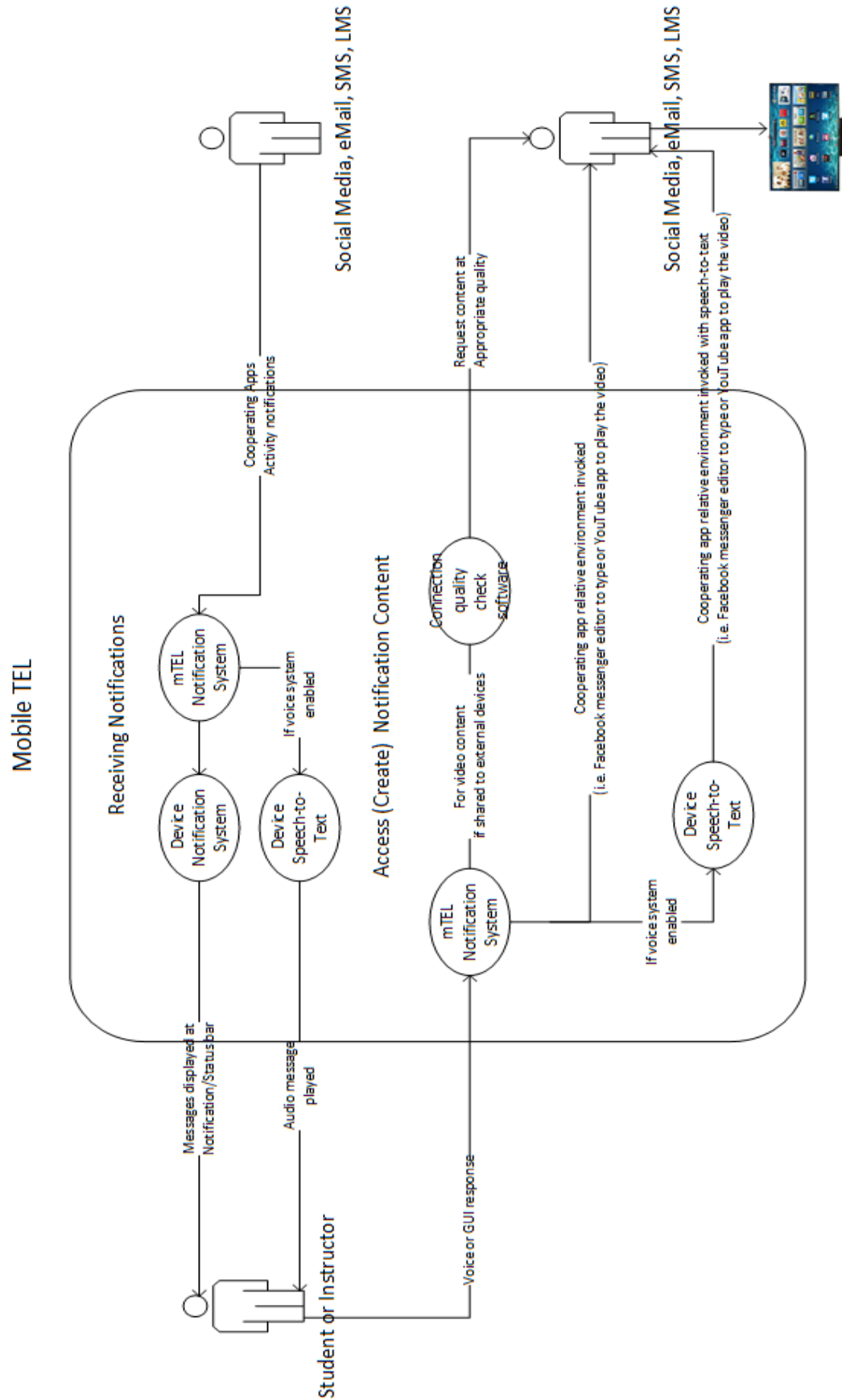


Figure 55: mTEL UML Diagram for user/mTEL/Apps interactions

As it can be seen in Figure 55, mTEL stands between the user (student or instructor) and the cooperating applications and services (i.e. LMS, Social Media, eMail, SMS, etc.). Its initial goal is to increase the awareness of its users with respect to learning related updates. This is achieved for all people (including certain categories of people with disabilities where applicable) utilizing the native voice system of their device which also provides the advantage of mTEL being able to convey notifications while the user is engaged with other tasks (i.e. driving).

However, mTEL aim is not only about awareness. As seen in Figure 55, mTEL enables the user to respond to the conveyed notifications by automatically invoking the appropriate cooperating app module simplifying and speeding up the response process (already discussed in section 5.4.4 Mobile TEL Decomposed Architecture). The utilization of the native voice command system used over the invoked response UI (for example to dictate to Facebook messenger editor) makes it possible for all mTEL users to respond even simultaneously with other engagements they may have. This reduces the time required to interact making possible for immediate and prompt responses that would otherwise may be postponed and possibly neglected.

Additionally, mTEL by utilizing the native share screen system, offers the user with the opportunity to use a more appropriate device, like a TV for example, to view the related content received by the eLearning notification. So, users that do not have access to a PC, may alternatively use a TV, instead of postponing the action for a later time when a PC becomes available. This option is furtherly enhanced by mTEL so that the right content quality is made available depending on the communication quality/method of the user's mobile device with the sharing

device, in our example a TV (more details upon this feature will be offered at section 5.4.5). This increases the variety of sharing devices that can be used and thus enables even more mTEL users to interact, without being restricted to campus or home due to availability of devices such as PCs. Since other devices like projectors may be used for sharing, mTEL offers the foundation for other options to be considered such as sharing learning content available online via a projector to a class.

All mTEL options, cannot be shorted in terms of importance as their importance depends on the circumstances of the mobile user. For a user on a trip, the sharing ability of mTEL might be of most importance, since it permits him to access content (for example in their hotel using the TV). For a visually challenged user, the utilization of the voice command system is probably the most important option offered and for the busy person the ability to respond to several activities while driving seems to be of high importance. All mTEL characteristics aim to support the core vision of the theoretical prototype towards creating a ubiquitous eLearning community within the reach of as many people as possible. At the same time, limiting access constraints and increasing the opportunity for more engaged users are very important for the success of current and future eLearning implementations.

Mobile TEL Setup

Once the application is launched for the first time, the user will be asked to setup the application (Instructions for this may be placed at the institutional web site or eLearning web application like blackboard). When setup is finished, the Mobile TEL will be able to connect to a variety of services such as Social Networks, Messenger Mobile applications, email applications, SMS services, Mobile

Learning applications, and the institutional web-based learning application. At the same time through a light Sync app, it will be able to connect to an application server as exhibited at the architectural diagram (Figure 49). During the setup, the user will be required to provide credentials and appropriate permissions for each one of the above services and applications he has already installed to his mobile device. This is required so that the Mobile TEL is enabled to use all installed existing technologies to keep the user up-to-date with any activity occurring in the community and disseminate information through them to other members of the eLearning community. These processes are described by the UML use case diagram of Figure 56.

At this diagram, the sign up and login process will use a web service to connect an existing mTEL user to the server side application. This application will in turn initiate the required web services to connect to and retrieve new notifications from

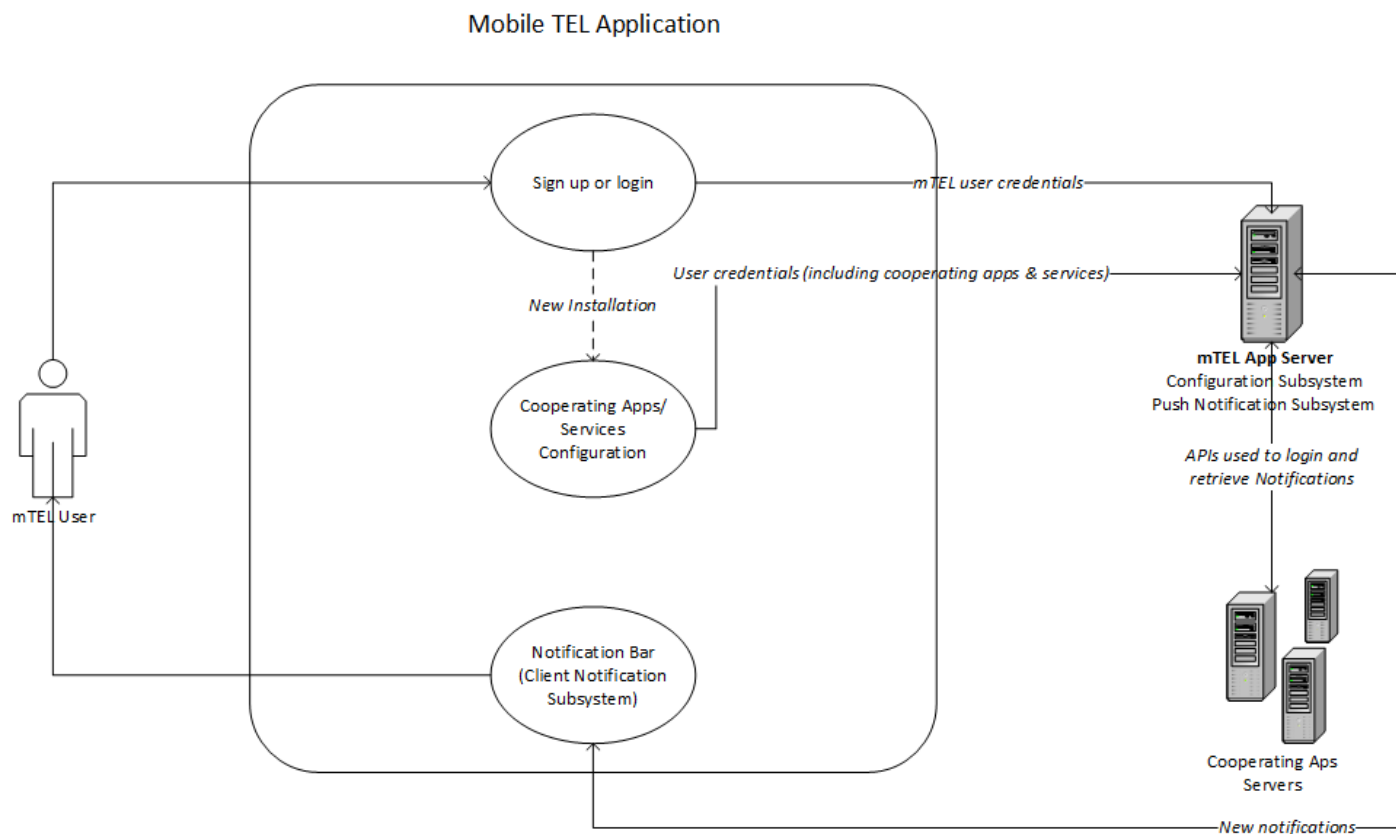


Figure 56: Setup UML Diagram

the cooperating apps serves based on the mTEL user's profile at the configuration subsystem (see Figure 54: Mobile TEL decomposed architecture). Alternatively, a new user will have to go through the configuration process as already described in this section. Once the user profile is created at the mTEL application server notifications are being pushed to the mTEL client application, so the user is informed.

Automatic Content Selection

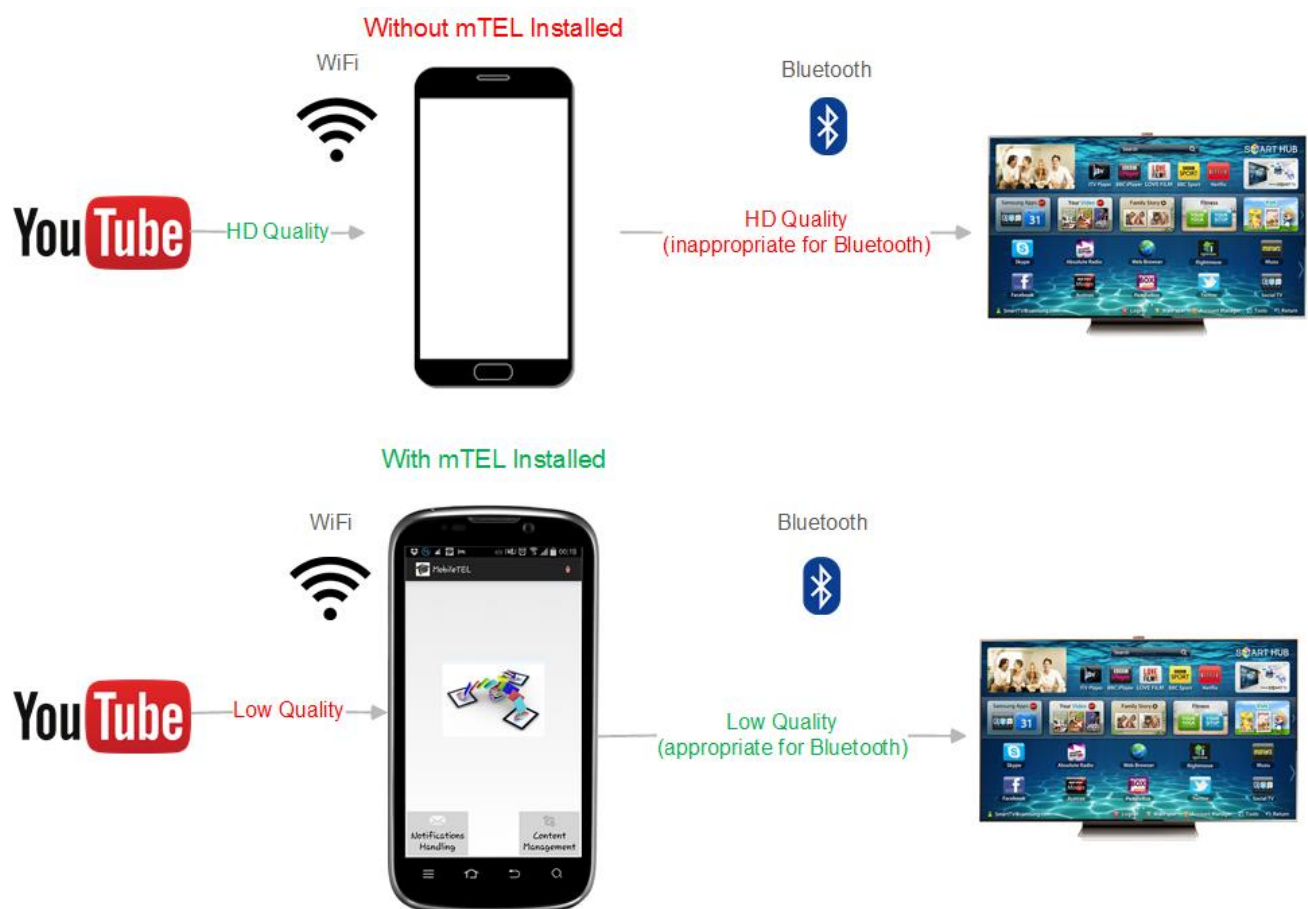


Figure 57: Appropriate content selection example

The data rate recognized by the streaming server, by default, will be that of the initial communication. In our example (see Figure 57), that would be the Wi-Fi connection between your phone and the streaming server (i.e. YouTube). YouTube, having identified the high-speed connection will automatically send a High Definition (HD) content if available. The user's device, without mTEL will attempt

to forward the received high HD stream through Bluetooth. However, the communication will never be real-time, while the final receiving device will obtain the video at a very slow speed making it difficult if not impossible to watch, because of Bluetooth speed limitations. The idea here is that Mobile TEL, controls the connectivity information sent by your device to the streaming server, so instead of sending data that relates to the higher Wi-Fi speed (which is the actual connection speed of your device to the Internet), it sends data that relates your device's connection to the data rate capabilities of the finally receiving device, in our example smart TV connected via Bluetooth. That way the streaming codecs will reduce the data rate making the content obtained by your device suitable to be transferred through Bluetooth to the finally receiving device. However, since compression used by the current codecs is "lossy", the quality may be significantly reduced (Ozer, 2009). So far, most devices can communicate at high speeds. Protocols like IPv6 offer even higher speeds by permitting multicasting instead of broadcasting which was a limitation of IPv4 (*Six Benefits Of IPv6 - Network Computing*, 2011). Hence, without this feature of Mobile TEL, sharing of large sized content through other than Wi-Fi mobile methods, (for example a learner using Mobile TEL as a medium to transfer content to a Smart TV via Bluetooth) would have been challenging. This feature permits users, who otherwise would disengage due to the inconveniently small interface of their mobile, to share Mobile TEL acquired eLearning content with other more convenient in size devices.

Voice Command System

Mobile TEL utilizes the existing Voice command services of the mobile device in which it is installed. Besides, this would be a complex technology to be developed

and embedded in a mobile application such as Mobile TEL. For example, Cortana (Microsoft's voice system) is linked to a variety of immense cloud based data sources and artificial intelligent systems so that it achieves, not only recognizing spoken words, but also their meaning within sentences, so it can execute the appropriate function as required by the user (Banks, 2014). As Ronald Banks states "Nowadays of course, nearly everyone with a smartphone is familiar with Siri, Cortana and Google Now as a natural way to search the web, send messages, or simply to elicit a humorous response." (Banks, 2014) Hence, it is judged appropriate, since such complex services are made available by the most popular smartphone platforms, to be inherently adopted by Mobile TEL. However, this implies that the ability to create, manage or modify content using Mobile TEL, depends on the ability of the native technology used for each platform and the options that its creators make available for developers to exploit.

Additionally, mTEL may be enhanced to check the accelerometer sensor of the mobile device (where applicable) and automatically offer to switch from the default UI to the Voice command system in case the movement speed of the device indicates that the user is driving.

Use-Case example - Mobile Virtual Classroom

Currently, eLearning platforms like Blackboard, support tools for conducting virtual classrooms. A virtual classroom is used here as a synchronous learning system (Hedayatpanahshaldehi and Hedayatpanahshaldehi, 2014) where participants are able to directly communicate with each other in real-time during the learning process. Furthermore, virtual classrooms permit the dissemination of content to the participants at real-time as well. So basically virtual classrooms use features such as audio, video, text chat, interactive whiteboard, and

application sharing through a web-conferencing system (Rockinson-Szapkiw and Walker, 2009). The main goal of such systems is to assist maintain interaction between the instructor and students, or between students as a group or even between students and content (Martin, Parker and Deale, 2012). Hence, the most important characteristics of such applications are support, assessment and communication between the involved members, instructor, content and students (Hedayatpanahshaldehi and Hedayatpanahshaldehi, 2014). Current virtual classrooms seem to be the ultimate constructivist tool but has one small weakness. They are only available through the web and currently, mobile versions of web based eLearning platforms do not have provision for such a feature.

Mobile TEL treats a Virtual Classroom similarly to all other activities for which notifications are received. Based on the activity that the user chooses to access, the Mobile TEL coordinates the available technologies to offer interaction that will maximize convenience and ease of access by the user. The Virtual Classroom eLearning activity is the one that requires multiple technologies to be combined to achieve the goal of constructive learning.

Mobile TEL provides access to Virtual Classrooms by coordinating these technologies with the available resources. The minimum that current eLearning platforms offer is to squeeze them all in the small inconvenient screen of the mobile device. Mobile TEL takes this to a further step by enabling the use of other, more convenient in size, devices in the area such as Smart TVs, another mobile device, etc. That way, the user may choose to disseminate part or all the content available to another device to decongest the mobile device screen.

The Mobile Virtual Classroom offers this functionality of disseminating virtual classroom content at real-time to any mobile device and through it to any other device with wireless capability in the area. The instructor may still need to use a laptop or a desktop for convenience since they usually have a more complex role as compared to their audience. The functionality is described below:

An instructor schedules a virtual classroom session on Blackboard at a given date and time. Blackboard notifies users by initiating a notification accessible only from the web and sending an email to all involved parties (students, instructors or even guests). Mobile TEL Sync function, retrieves the notification on behalf of the invited members and issues a notification at their mobile device notification bar as described in Specification 8, prompting users to take action with it. In addition to that, the Mobile TEL may push the notification to invited members through a preset group of cooperating applications or services (such as social networks, messengers, SMS, etc.). Just because of these features the Mobile TEL, achieves to promptly notify invited members even if they don't check their email or visit the Blackboard system. They will be also notified by their social network application (i.e. Facebook), thus increasing the probability of engagement to the system.

At the other end of the communication there may be students or even other instructors. Hypothetically speaking, at the time of the meeting, one of the students is on a business trip at their hotel. An invited guest instructor in another university wants to have his class attend the lecture. In both cases, the available technology is their smart phone and a smart TV. Mobile TEL's specifications (see 5.4.2 Specifications), will permit their smart phone to transmit any content that will be made available to the virtual classroom to the Smart TV set they have

access to. The content will be made available irrespective of the quality of communication between the smart phone and the TV set since Mobile TEL's Specification 3 will choose the most appropriate method (if applicable) to compress the distributed content to a size that will make its presentation possible. That way, Mobile TEL increases the number of engaged learners since it makes it possible or more convenient for them, to attend the classroom without the requirement of using the web-based eLearning application, in our case Blackboard.

Finally, Mobile TEL virtual classroom would be able to project a variety of content distributed to the members of the class, directly through itself at the mobile device of the users or any nearby device that can be connected. Although, smaller screens used by these devices may not be as convenient as desktop monitors, current mobile devices and expansion and improvements in the telecommunications technology, offer a solid ground for mobile devices to access, download and project high quality content, like streaming video, at very high quality levels including High Definition. Therefore, the virtual classroom may include members whose only means to participate is a mobile device, like commuters. So, if a student is commuting, by bus or train, from their work to home, at the time of the meeting they may still attend it. Although attendance does not equal engagement, it is better than no attendance, while it can be argued (Rapposelli, 2014) that the more people attending the higher the probability for more students to learn thus successfully fulfilling the educational goal. Besides, engagement may be one way to learning but it is not the only way. mTEL is not mostly about engagement. It is mostly about learning that anything that leads to that aim is to be considered as valuable.

5.4.6 Mobile TEL Theoretical Model Data Flows

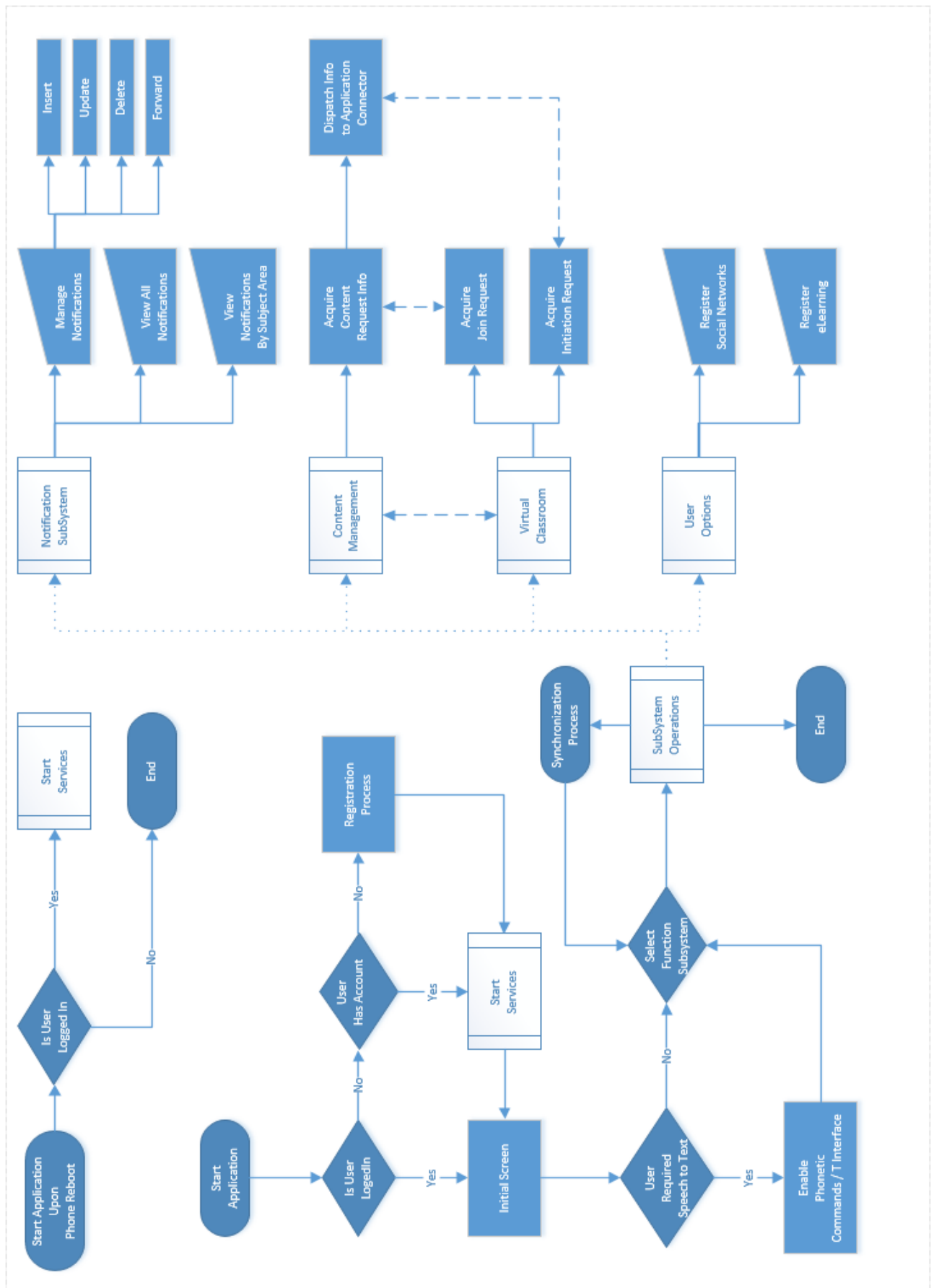


Figure 58: Mobile TEL Level 0 Data Flow Diagram

The Mobile TEL application will have two alternative start points as described in Figure 58. The Data Flows displayed in Figure 58 are described in sections below:

Start upon Reboot

Once installed, Mobile TEL starts automatically after mobile device reboot. If application configuration has not yet been completed by the user, in order to be configured to communicate with cooperating services (in other words the user has not logged in yet), since there is nothing to else do, the application will end. However, if the user has already run and configured the application, then the Start Services process group begins. During this stage the Mobile TEL will connect to all configured cooperating services (web and mobile where applicable), such as

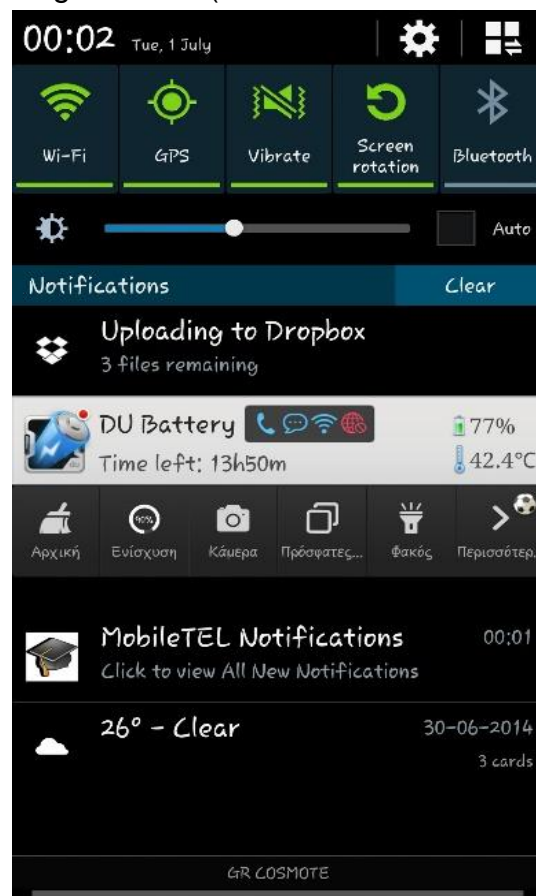


Figure 59: Android Notification Screen - mTEL Prototype Notification

Blackboard, Course Facebook Page, Facebook Messenger, Viber, etc. Once the

connection has been established, Mobile TEL goes into a standby mode, ready to receive notifications pushed through connected services. If notifications are available, Mobile TEL will receive them and display a notification icon at the notification bar of the device and a notification short description at the pull-down notification screen of the device as seen in Figure 59 above.

A Mobile TEL UML graphical representation is presented in Figure 60:

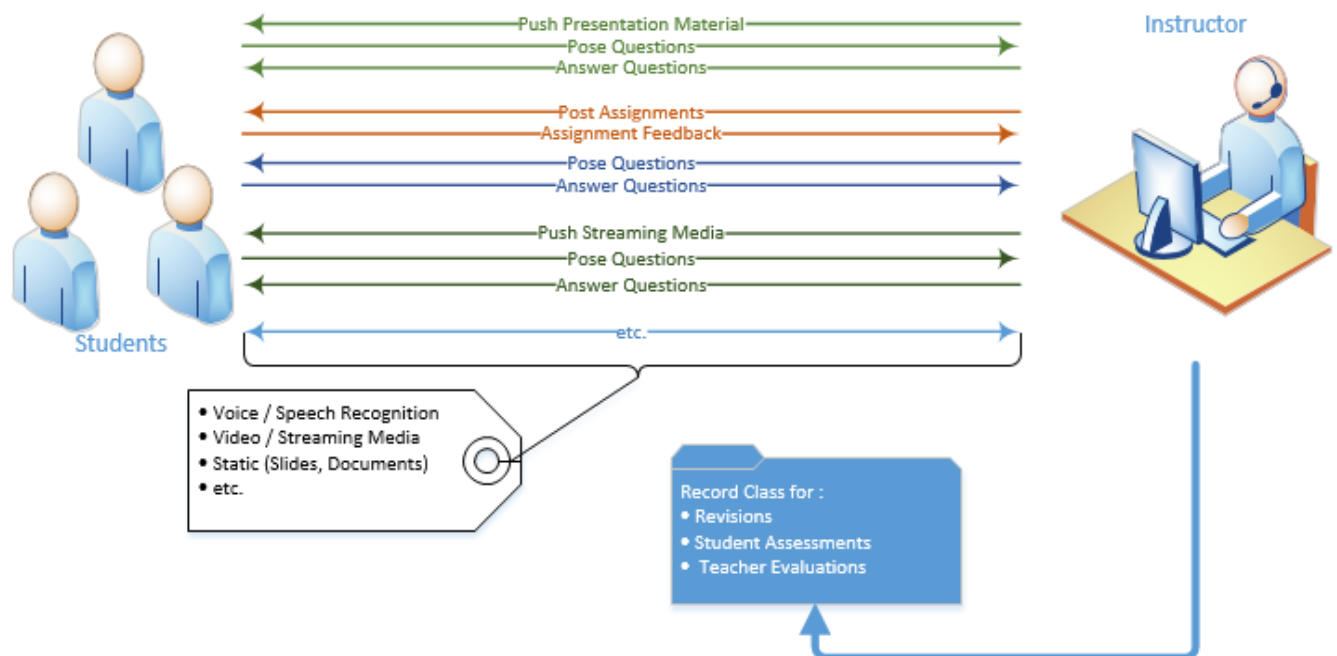


Figure 60: Mobile TEL Unified Modelling Diagram

Manual Start by the User

When users open Mobile TEL at their devices, the User Login process is initiated if the user is already automatically connected as described above. Since it might be the first time that application is used after installation, the registration process is initiated if necessary. The registration process includes the registration of the user in a Mobile TEL learning community and the configuration of Mobile TEL

with respect to its connectivity with the cooperating third-party applications like Blackboard or Facebook (see Appendix I). Once this has concluded, the Start Services processes are initiated in order to connect the Mobile TEL with the cooperating services as described in detail in the previous paragraph.

Once connection has been established the Initial Screen is displayed as shown in Figure 61 providing the user with access to the Mobile TEL Interface. At this point the user may also enable the phonetic commands interface and using any

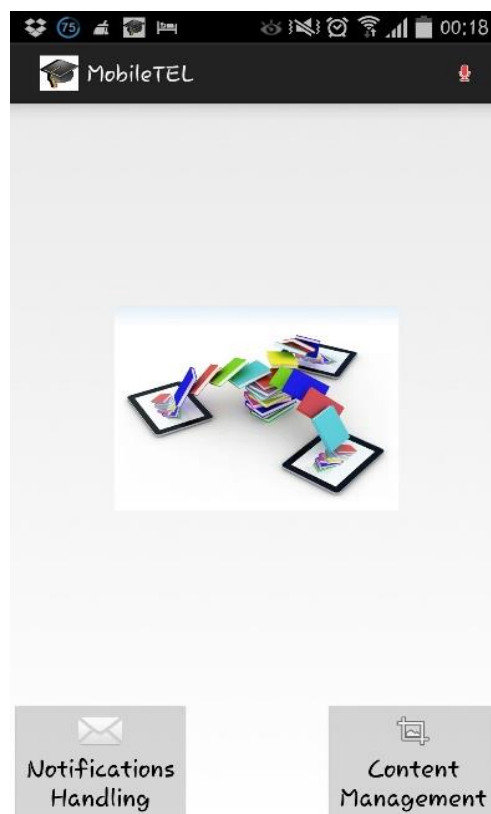


Figure 61: Mobile TEL Prototype Initial Screen

interface they prefer, select a Function Subsystem (e.g. Notifications Handling or Content Management).

Before the selected subsystem is executed, the Mobile TEL will perform a Synchronization Process as described in Specifications.

Once synchronization has finished the Mobile TEL will make the following subsystems available on demand based on the user's selection at the interface²⁸:

NOTIFICATION SUBSYSTEM

The Notification Subsystem is responsible for the management of notifications (i.e. Insert, Update, Delete, Forward, Mark/Unmark for action, etc.).

It is also responsible for viewing all notifications (lists of notifications) or providing filtering tools for viewing subsets of notifications as for example notifications per subject area if the user is a participant in many courses, etc.

CONTENT MANAGEMENT SUBSYSTEM

Permits the creation, retrieval, modification and dissemination of a variety of content types by offering a mobile editor capable of managing several types of contents. In cases of large contents like audio or streaming video, it will test the quality of direct or indirect connection (for example, when the Mobile TEL device is used to forward the content into another device via a low quality communication method such as Bluetooth) to the content server and dispatch information to that server. Content will be acquired at the most appropriate data rate or format, for the overall quality of the communication, if applicable and as described in Specification 3. Of course, this process does not occur when a simple content is involved like questions via email or a course forum, or a messenger message. In such cases, the Content Management subsystem just acquires the content into its own editor or opens it by invoking the originating application based on the user's choice where applicable as described in Specifications.

²⁸ All subsystems are available both after reboot and upon manual start.

VIRTUAL CLASSROOM SUBSYSTEM

The already demonstrated Virtual Classroom cooperates with the Content Management subsystem by using it to communicate join and initiation activities, for scheduled Virtual Classrooms.

Mobile TEL functions are all designed in an object-oriented fashion which allows building on existing building blocks to offer a variety of functionalities which inherit characteristics from a parent object upon which they add their extra functionality.

The Mobile TEL Virtual Classroom is the highest most complex function of Mobile TEL that has been designed on existing native and external technologies (modules)²⁹. That is because the Virtual Classroom combines functions and services of eLearning technologies simultaneously in one place such as Streaming Video, Conferencing, etc.

USER OPTIONS SUBSYSTEM

The User Options Subsystem provides the Mobile TEL User with a variety of options. The most important is the Registration of the Mobile TEL to the cooperating services. The user will automatically be transferred to this subsystem if no registration has taken place upon every execution of the application. However, the user may initiate this subsystem on demand to change the configuration settings of an existing registered service or register a new service.

²⁹ This refers to third party applications and services like Blackboard or Facebook, but also to software libraries and available scripts or software modules that can be embedded in Mobile TEL and offer certain functionality, like the content editor.

Mobile TEL Virtual Classroom Data Flows

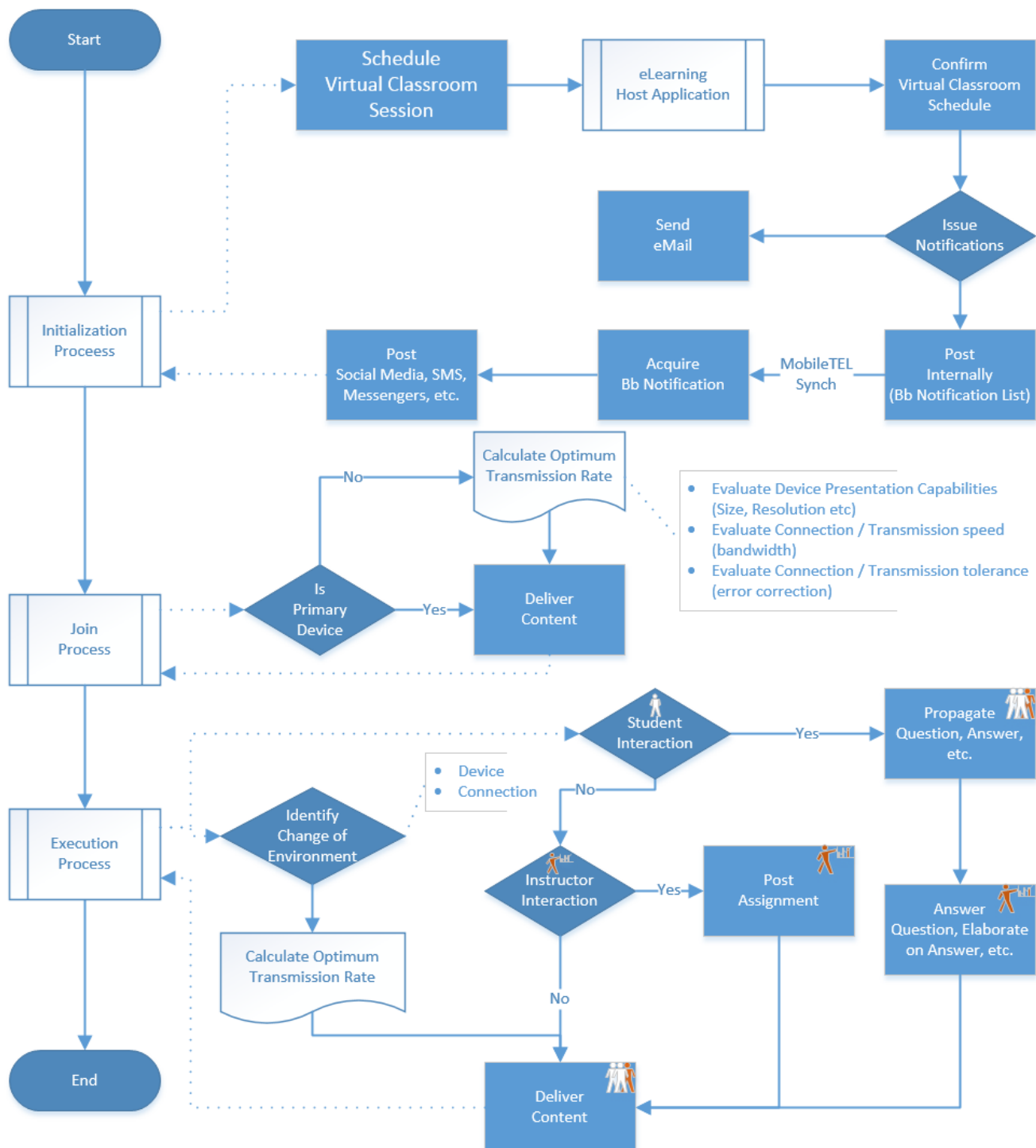


Figure 62: Virtual Classroom Data Flow Diagram (colored users represent instructors; white ones represent students)

The description of the Virtual Classroom data flow is mainly used to describe the detailed operation of the whole application since the Virtual Classroom combines them all. The Virtual Classroom function is based on three major processes. The

Initialization Process, the Join Process and the Execution Process (Figure 62). These three processes are executed consequently.

INITIALIZATION PROCESS

The process includes the following activities:

To schedule a Virtual Classroom Session at the institutional eLearning platform. In our case, Blackboard will be used as an example of an institutional eLearning platform.

The virtual classroom may be scheduled both directly from Blackboard and by accessing Blackboard through the Mobile TEL application. Though it may be inconvenient to schedule a Virtual Classroom through using small sized mobile devices, still if this is the only way, it can be done with Mobile TEL.

Once scheduling is concluded the instructor confirms the schedule. At this point Blackboard posts a notification at its own native internal notification system (Figure 62: Post Internally action), which leads to an announcement in the Virtual Class Blackboard Course Container (Blackboard, 2013). Since Mobile TEL constantly receives notifications by all cooperating services including the institutional web-based eLearning platform, it will acquire the notification from Blackboard for the scheduled class and push it to all available services selected by the instructor and configured by students in their Mobile TEL installation. Consequently, students will not only receive a notification within Blackboard, but also possibly through Facebook (and its own notification system if Mobile Facebook is installed in the device), Viber, messengers or even SMS if enabled. An email, although not preferred in this case due to redundancy, it is anyhow sent by Blackboard with the virtual classroom announcement.

Mobile TEL notifications of the event as reminders, might be scheduled to be sent repetitively, in predefined by the instructor time intervals as the event time approaches.

As a result of this process the probability of conveying the announcement to a larger audience in time is expected to significantly increase.

JOIN PROCESS

This process occurs when the time for the scheduled class has arrived. Before acquiring any content that has been pushed by the instructor for the needs of the class, Mobile TEL will check if the content is to be delivered at a cooperating device (such as a Smart TV) in order to calculate the optimum transmission rate based on the quality of the connection between the Mobile TEL device and any other device connected through it. The outcome of this check will be used by Mobile TEL to acquire the content in a suitable for the transmission quality and size as described in Specifications. Once the right content is acquired, it is delivered to the preferred device.

EXECUTION PROCESS

The execution process refers to all activities taking place during the class session and primarily with the interactivity between the class participants. For that reason, before any execution process is initiated by any activity happening during the session, a change of environment routine runs to identify possible newly indirectly connected devices so that it delivers the right content as described in the previous paragraph. Thereafter the execution process constantly runs retrieving and disseminating interactions among the class members through their Mobile TEL installations. Interactions may include questions and answers or posting

assignments which may have content that will re-initiate the change of environment routine. Retrieving and disseminating interactions between class members, based on Specifications 6 and 8, will be communicated through a variety of connected services in the participants Mobile Devices. Such communication will be almost real-time because of the constant synchronization of Mobile TEL, thus motivating participants to engage more actively by keeping them involved anywhere they are during the class session.

5.5 Chapter Summary & Conclusion

The Mobile TEL theoretical model offers the specifications and the initial basic designs to build a mobile application that aims to reduce, if not eliminate, the shortcomings of current eLearning applications. Although such eLearning activities are probably state-of-art in modern learning, both students and instructors mostly use eLearning platforms as Content Management Systems for making course related and other material available to the learning community.

Mobile TEL attempts to provide a mobile technological solution that will take advantage of the already existing and as research shows, engaged by students and instructors, services (i.e. Social Media). It relies on current mobile technologies. It uses a similar HCI logic with that used by popular mobile technologies with which students and staff are already familiar. Emphasis is placed on designing a simple, common-sense interface, with easy navigation. It considers and takes advantage of the positive instructor opinion on the use and impact of technology both to education and administration (Alkhalaf *et al.*, 2012). It enhances current eLearning applications by offering a mobile application that makes them ubiquitous, reaching a potentially larger student population without any geographic constraints and possibly bypassing obstacles caused by their

professional or personal obligations. It keeps all participating members aware and updated of activities occurring in the eLearning environment and provides them with the opportunity for an immediate, simple and time reducing way to respond thus increasing the probability for more users to successfully participate in learning activities. Mobile TEL achieves to create a ubiquitous Virtual Mobile Learning Community with a higher potential to achieve its educational goals.

Furthermore, there are indirect advantages such as giving meaning to the purchasing and mainly maintenance costs of existing eLearning applications by making them essential in the Mobile TEL functionality. Thus, by increasing the effectiveness of existing institutional eLearning platforms it justifies their operational expenses and the investment made for them.

Finally, it diminishes most cost factors usually present in such technologies. This is achieved by using mostly existing technologies. Mobile TEL itself is basically an application that requires a simple initial setup to organize access to various mobile and desktop applications and services toward directing their functionality towards learning. For example:

- It does not require development of complex social media coding.
- It does not require a cloud to support Voice Command recognition.
- It does not require a dedicated application server, etc.

Hence, development cost will be kept to a minimum while at the same time, upgrade costs are not required since the cooperating applications will do that anyhow.

6. Mobile TEL Application Evaluation

To evaluate the potential value of the Mobile TEL (mTEL) application three surveys were organized and deployed to students, instructors and research experts as described at the methodology section below. The aim of this chapter is to prove through experts and potential users that the mTEL application succeeds in the objectives described in the previous chapter. Also, it will be examining whether mTEL provides an innovative insight in creating a new technology that will significantly assist in the fulfilment of the objectives of current eLearning technologies, while indirectly enhances and improves the overall learning process for both students and instructors.

6.1 Methodology

Due to time, budgetary and other constraints, a fully operational working version of the application was not developed. A small mobile prototype was developed only because it was considered as the most appropriate way to present the UI. Screenshots of that prototype were used to support the thesis and were included in the evaluation presentation discussed below.

However, the goal of this research is to present a theoretical model design that may be used to produce an actual working application at a next stage after being assessed by the evaluators but not as part of this thesis. As it is derived from the previous chapter, such an attempt would require considerable time, funding and the team effort of several, specialized developers. Therefore, the methodology followed, aimed to record the positive/negative feeling or concerns of students, instructors and experts towards this concept and the model's potential to successfully meet the requirements for which it was designed. With this evaluation, the aim is not only to record the behavioral perception of participants

as users of the technology recommended but also as members of distinct groups (i.e. students, instructors, experts). Therefore, this evaluation seeks to establish if students, instructors and experts believe that the presented theoretical model would lead to an application that would serve as a beneficial contribution to learning by enhancing the potential of current eLearning and blended learning methods and implementations. Additionally, the surveys attempted capture the intend of the participants to adopt an application that would be the product of the proposed theoretical model, based on their opinions and concerns that rise from the presentation of the model.

Towards this aim online surveys were created for two categories of people: Students, Instructors. Descriptive statistics were chosen as the most suitable method for these surveys. Although such type of statistics are used mostly to describe the basic data collected by a quantitative survey, they do describe what the data shows and they succeed forming a basis for quantitative analysis (W. Trochim, 2006). At the same time, having implemented the same method already in this research twice, it was found, that given the target population and the number of participants, satisfactory survey results could be produced in one academic year³⁰. Considering that these surveys also needed to be preceded by a presentation and possible clarifications, they were held in small groups of student (5-10 participants for students and 1-5 for instructors). That increased the time required thus making this method the only possible to fit within given time constraints. Additionally, this was achieved, with the minimum sacrifice in terms of their outcome accuracy due to the nature of the research, that was to establish

³⁰ Two semesters (3-4 month academic periods, highly populated periods by students) and two sessions (1 month academic periods moderately populated by students) based on the Deree College schedule.

intentional behavior towards a theoretical model. Experts evaluated mTEL through a qualitative process that included a presentation of the prototype and an evaluative discussion. This approach was chosen for experts since their role not only was to establish not only intentional user behavior towards mTEL but to also confirm the alignment of the model with eLearning theory and its feasibility in technical terms as a software thus enforcing the reasoning leading to its contribution to education. Evidently, the chosen method leaves a small gap for further analysis. However, the intention established based on the used method seems to adequately serving the goals of this project. Nevertheless, continuation of this project may require further research that may support the current findings depending not only on the circumstances but also constraints at the time.

6.1.2 Students and Instructors

The surveys were deployed at Deree – The American College of Greece academic community of students and instructors.

A plain language explanatory statement (Ryan and Xenos, 2011) was used for both categories of participants to inform them about the aims of the survey, the survey anonymity and the participants' opt-out rights. (See appendix III)

Before answering the actual questionnaire, a common PowerPoint presentation was shown to small groups of students and instructors (three to five people) from all disciplines offered in the institution. The presentation content had two goals:

1. To convey the rationale for the development of the model and what was intending to succeed in relationship with the combined findings on eLearning methods and the research findings which led to the mTEL model objectives.

2. To demonstrate how these objectives would be implemented if the model is developed. That was achieved using demo interface images taken from the UI prototype that was created. Those images served as a visual reference to the UI of mTEL. This was also chosen as the only one suitable way to provide user intend within the time and budget constraints.

As already observed, based on the outcomes of this survey, additional research methods or even the development of a working prototype, may be decided in the future at a next future stage.

The presentation was accompanied by a digitized voice narration. This method was preferred over personally presenting the presentation in order to make sure that all audience received the same insight during the presentation and there was no bias.

At the end of each presentation a question and answers session was offered to the participants. Finally, the participants were directed to an on-line survey to provide some demographic and mainly evaluation data on mTEL divided into two corresponding sections. The questions asked, aimed to record an evaluative opinion on the proposed benefits with respect to the presented theoretical model. The aim was mainly shaped in terms of offering enhancement of eLearning productivity at large (considering educational goals but also user time and access and other restrictions) and secondly in terms of technical simplicity, leading to acceptance by the users. The question types used were Yes/No, multiple choice, multiple answer, array and one open ended question. 120 full responses were processed equally distributed among 60 students and 60 instructors. Simple, quantitative questions were selected so that an adequate, considering the resources and time restrictions, multidimensional audience of users (students

and instructors) was reached. The participants completed the survey process with the presence of the presenter who was available to provide clarifications to participant questions.

The survey tool that was preferred was the LimeSurvey web application, Version 2.05+ Build 150520 (latest version at the time). The reason for this selection was that LimeSurvey is an Open Source, therefore free, easy to install on existing private hosted servers which was the only cost effective choice. Nevertheless, LimeSurvey, is a powerful survey implementing tool with equivalent value with other known commercial web based platforms.

6.1.3 Experts

Experts were approached within the context of a behavioral qualitative study that tried to identify the users' perception of mTEL's, its overall functionality as well as its specific features within the context of Higher Education.

The term Experts in this report refers to academic researchers from all over the world who have proven their expertise in eLearning and related fields through published work and academic appointments in the last 10 years. Moreover, some of them have actively participated on corporate projects on the field or have participated in international committees directly related to eLearning and education.

Experts were selected using a variety of sources. These included:

- Authors of sources examined at the literature review chapters of the thesis that offered contact data at their publications,
- Researchers with eLearning research interests found in research sites and communities like Research Gate and,

- Researchers introduced by colleagues who had some form of personal or professional association with them.

Thirty-four (34) experts were invited via email to participate in an online presentation of a special more technical PowerPoint presentation. From those, six agreed to contribute with their expertise to this research eventually resulting in five interviews (One of the experts dropped out due to time limitations). The process and discussion was facilitated through Skype. The qualitative method most appropriate to be used due to the nature of the research and the means to present a theoretical model to experts through interviews. Since the evaluators selected come from different countries the only method to conduct these interviews, within the limitations of this research, was using videoconferencing (i.e. Skype). Experts were informed and have accepted their evaluative interview that followed the presentation to be recorded in order to be used for the evaluation of the proposal of this thesis. At the end, it was decided that the contribution of one of the experts would not be included as it was found not to completely fulfilling the eLearning background requirements set by the implemented methodology. His research was more focused towards software engineering rather than eLearning. For that reason, it was decided not to be considered in this research, despite the very positive evaluation he provided. These recordings were used for a qualitative analysis of the evaluation remarks of the Experts. The interview sessions had a duration ranging between 14 and 46 minutes depending on the discussion detail and clarifications required by each expert (for example the largest session made with Professor Udo Bleimann expanded in several technical clarifications since Professor Bleimann has also extensive software engineering expertise).

The interviews followed a semi structured logic based on discussions on specific questions corresponding to each of the presented features and an overall evaluating quantitative rating question (1-5 where 5 is overall exceptional). These questions served as common discussion topics with all experts.

The experts did not ask for a transcript or summary of the interviews. In specific cases, it was asked that the digital recording would not be made publicly available, thus recordings are stored in a controlled access repository.

Following, is the summarized profile of the selected experts used in this survey (Detailed CV's may be found in Appendix VI):

Dr. Lucie Rohlíková, Ph.D.

Czech Republic

Senior researcher and lecturer at the University of West Bohemia in Pilsen (Czech Republic). Over the years acting at various positions including vice-dean and director of the distance education center.

Profile

Dr. Rohlíková holds a Ph.D. in pedagogy focused in Distance Learning and comes from a pedagogical educational background. She has published several eLearning related papers in peer reviewed journals and has authored and edited eBooks and electronic support materials. Finally, due to her position as the director of the distance education center she has a wide experience of TEL implementations.

Dr. Margarida Rocha Lucas, Ph.D.

Portugal

Postdoctoral Research Fellow at the University of Aveiro

Profile

Dr. Lucas holds a Ph.D. in Multimedia in Education from the University of Aveiro. She has served as a Postdoctoral Research Fellow in several Technology Enhanced Learning (TEL) projects and some education related projects. She is currently participating in two postdoctoral research projects: (1) Mobile Learning, Augmented Reality and Geocaching in Science Education and (2) “EduLabs - evaluating their impact on students’ digital competence: a study in Portuguese middle schools” both related to eLearning and mLearning.

She has co-authored three books, one of which in the TEL field, while she has contributed published book chapters in several TEL related books. Additionally, she has published six articles with scientific references in TEL and related areas and seven in conference proceedings. She has been several times as member of committees, boards and chairperson in national and international conferences, symposia, and editorial review boards in TEL and related areas.

Professor Miltiadis D. Lytras, Ph.D.

Greece

Assistant Professor at Deree - The American College of Greece

Profile

According to his 22-page CV, Professor Miltiadis D. Lytras’s research interest are on semantic web, knowledge management and e-learning. He has more than 150 publications in these and related areas. Professor Lytras is considered a world class expert not only in the field of eLearning but also in directly related fields

such as knowledge research, social web, semantic web and learning management.

Professor Udo Bleimann, Ph.D.

Germany

Chairman Advisory Board Institute of Applied Informatics Darmstadt (aiDa)

Profile

Despite his educational background in mathematics and economics, Professor Bleimann, very early in his career started serving the information technology and computer science sector in a variety of academic and top-level administrative positions. He is the author, editor, and co-author of many books, publications, journals, conference proceedings, etc. During the last ten years, he has focused his research in eLearning technologies and practices, authoring and co-authoring an impressive list of publications. He has also participated in several activities and appointments in a variety of Computer Science areas in addition to his profound list of publications thus making him a suitable evaluator not only with respect to the eLearning scope of mTEL but also in terms of its technical feasibility with respect to software engineering.

6.2 Student & Instructors Survey Data Analysis Findings

The following section presents the student & instructor data analysis findings to confirm that the findings are in alignment with mTEL objectives as discussed in section 5.4 Application Objectives, Requirements, Specifications and Design.

6.2.1 Demographics (Students and Instructors)

There were 28 female and 32 male students participating in this survey providing an almost equal distribution of genders. Additionally, there were 31 female and 29 male instructors that have also participated as shown in Figure 63.

Not only most students and instructors use a portable computing device such as a Laptop, Tablet or Smartphone, but most of them own at least two of such devices. The most popular devices are the Laptop/Notebook and the Smart Phone (Figure 63), with the Smartphone being the dominant one. Both populations have very similar distribution of mobile device use and seem to have well adopted mobile technologies in their daily lives providing the hardware foundation required to develop mTEL.

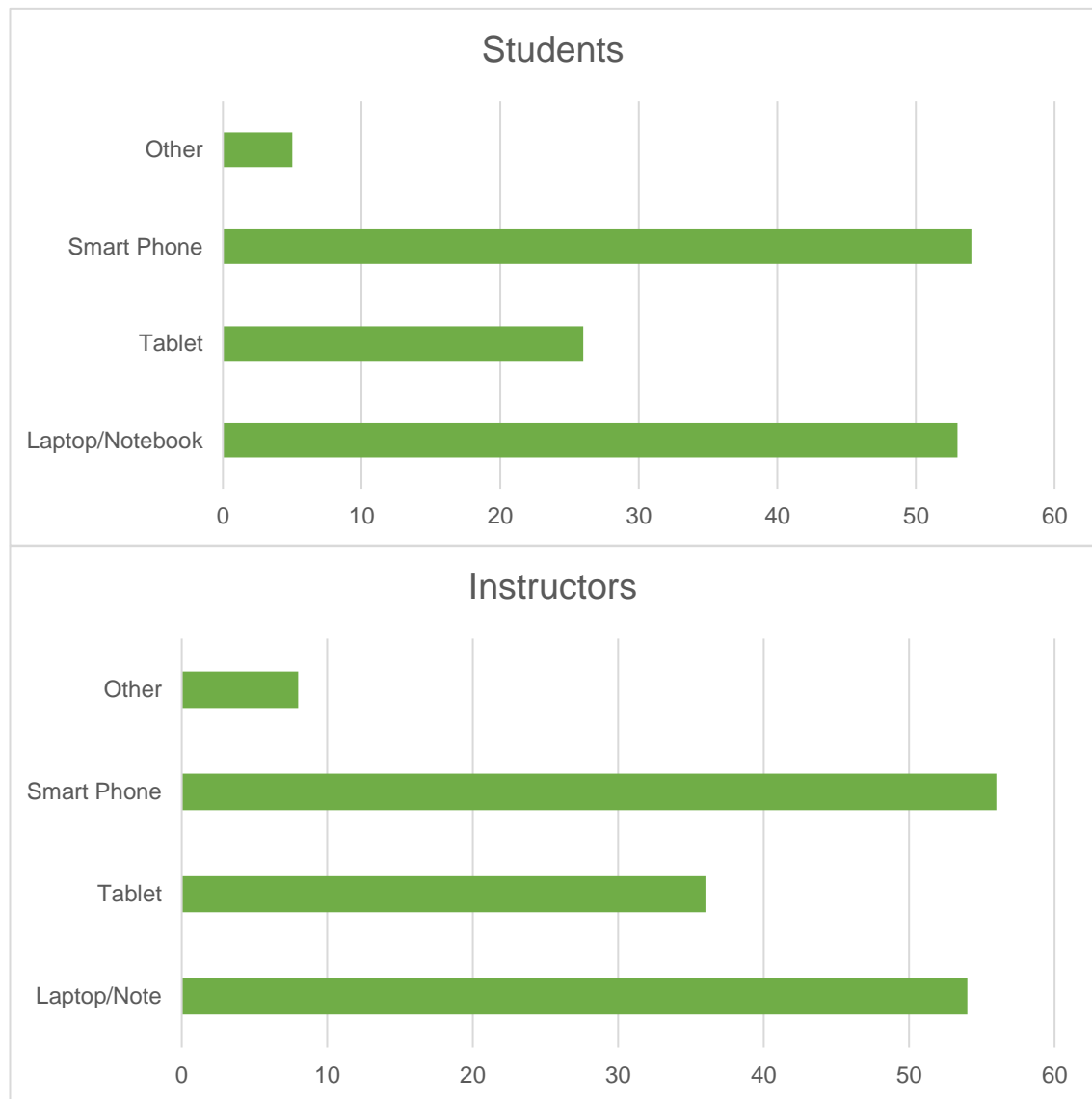


Figure 63: Use of Mobile Devices by Students & Instructors

In the “other” option, all instructors indicated the use of a desktop computer while there was a student that indicated the use of a Smart TV. With respect to the Desktop Operating System used, the most popular one is Windows (Students: 72% - Instructors: 73%) with Apple’s OS-X second (Students: 17% - Instructors: 20%). Furthermore, with respect to the Mobile OS used (Figure 64), there seems that iOS is slightly more popular than Android among students (52% iOS - 45% Android), while instructors seem to clearly prefer Android devices over iOS devices (65% Android – 29% iOS). There were also some very few insignificant followers of Mobile Windows devices. Considering all, but also the nature of the

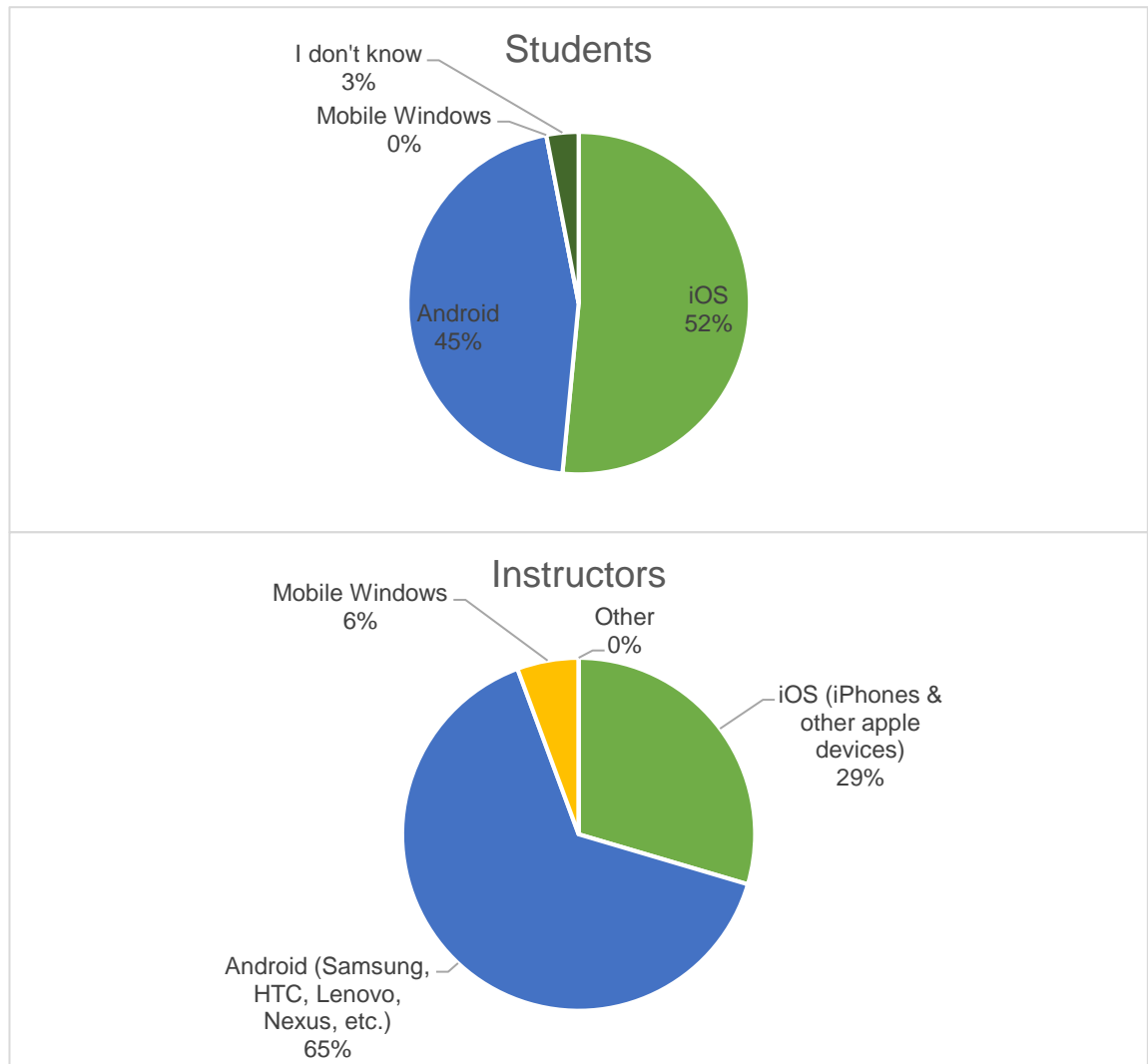


Figure 64: Use of mobile platforms based on OSs

operation of mTEL, it seems that the application should be build and released in both operating systems. The difference between mTEL and commercial apps, is that the availability of the application to all or at least the majority of the learning community is a requirement for its success. A commercial application may have the option to be released first for one platform and if successful, development and release for an additional platform may be decided. However, in the case of mTEL, with the above statistics in mind, releasing it only in one platform will cause the service provided by mTEL to fail since the key element of mTEL's success is that the service is offered to the majority of the members of the learning community.

Therefore, cross-platform availability should be considered as a prerequisite of mTEL implementation.

Up to this point the survey establishes that the devices required are widely available among mTEL target population. It is important to also establish that the majority of the population is actually using those devices and especially Smartphones through a variety of applications, thus having adopted a mobile app culture. Since the participants are actually using various apps, it can be safely assumed that the target group is experienced enough, to easily accept a new application without resistance even provided that the interface and functionality are not more complex than the currently used popular apps. At the evaluation section of the data analysis, it will be shown that mTEL is providing an interface, that according to the participants, is easy and common sense to use.

The survey data confirms the use of mobile apps by 93% of both student and instructor populations while in Figure 65, it can be observed that the majority of the population uses on-line services that are or can be addressed by mTEL, based on its open-architecture design and logic.

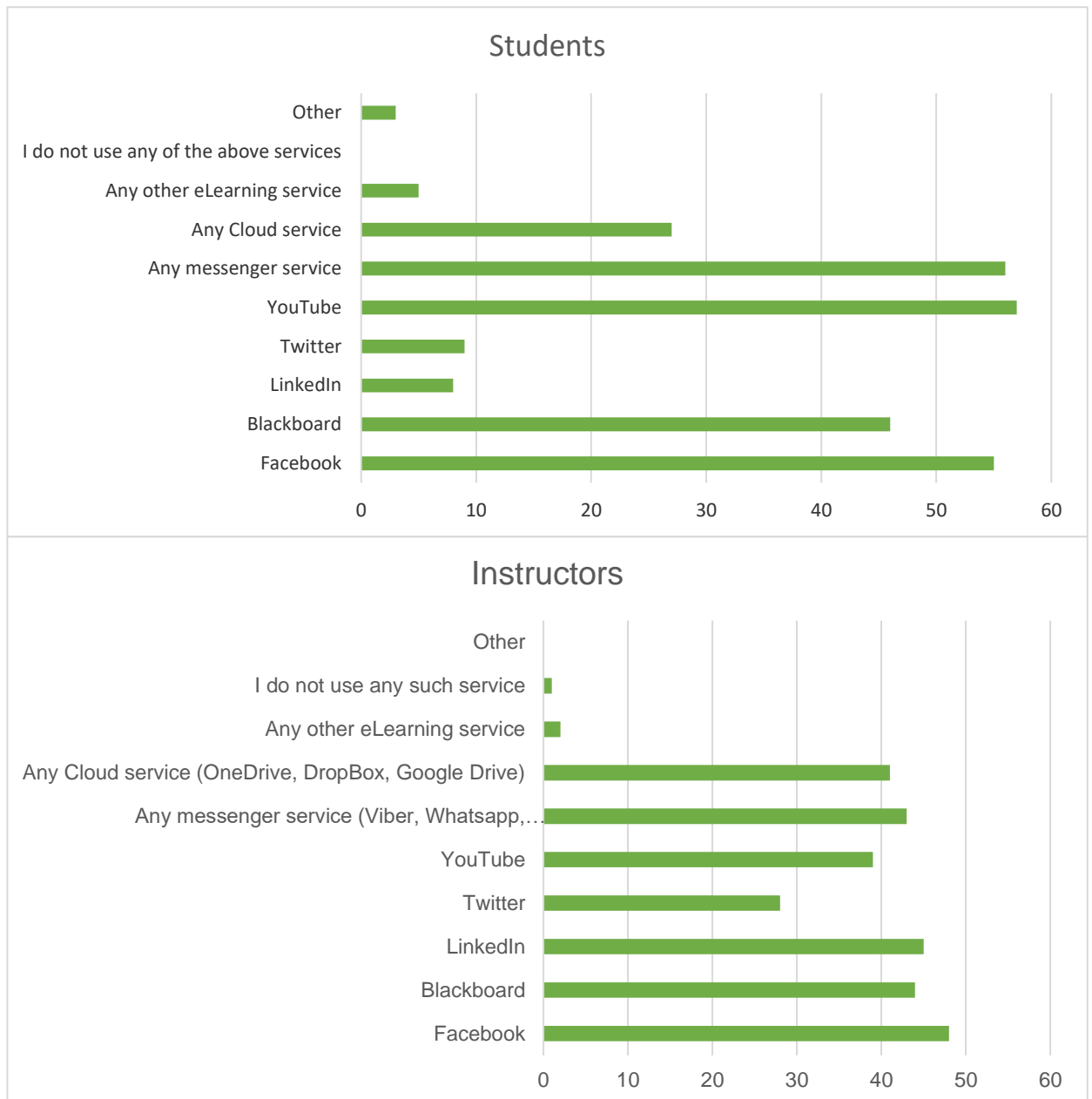


Figure 65: Use of on-line services by Students & Instructors

Therefore, based on the statistics collected on the use of on-line apps by the majority of the population, it can be safely assumed that the existing mobile app experience and culture for using mobile applications such as mTEL is widely available in the higher education ecosystem, a fact that acts favorably for the adoption of mTEL by the community.

The next question is of particular importance. All participants, both students and instructors, were asked whether they have connected their account (profile) of

any Internet service they use (including Social Media) with any students or instructors correspondingly. For example, whether students and instructors are “friends” in Facebook or have a follower connection among them in Twitter, etc.

The survey results depict that a large majority mainly of instructors (72%) but also students (57%) have connected their personal accounts between each other, not only granting access to their personal profiles (which could have been a barrier due to privacy) but also establishing an alternative, mostly real-time (due to extensive network coverage and mobility), means of communication (Figure 102 – Appendix IX). For example, Figure 66 that provides a visual representation of the results with respect to Facebook, it can be observed that 77% of the students and 70% of the instructors, access Facebook either daily or several times in a day.

Other Social Media such as Twitter and Google Plus were investigated but they were considered as insignificant for the current survey because of the popularity of Facebook among the participants of the survey sample. Most participants do not have an account or have a mostly inactive account in other Social Media.

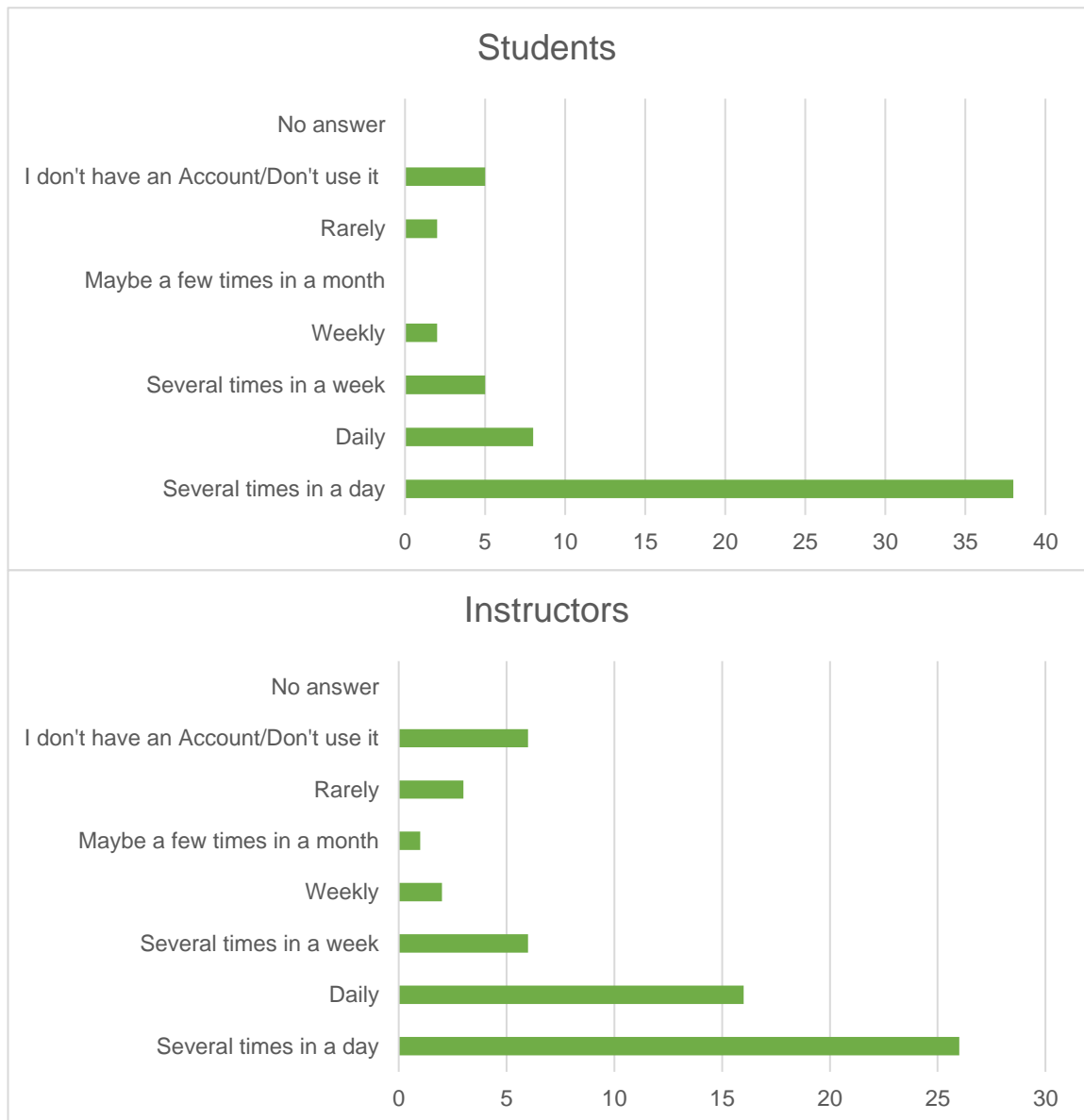


Figure 66: Facebook frequency of access

Furthermore, the absence of activity in other social media is a plus to the operation of the mTEL app provided that just one such service, in this case Facebook, needs to be popular and revisited enough to enable the academic community required by mTEL. The survey results with respect to Facebook confirm the existence of such critical mass. Facebook popularity is also globally

confirmed by Alexa.com (*Alexa Top 500 Global Sites*, no date) to be the most popular and revisited socila media service world wide, ranked third after google search engine and YouTube. Specifically in Greece, according to Alexa.com, Facebook is ranked second after Google.gr (*Alexa - Top Sites in Greece*, no date).

Additionally, the servey analysis indicated that Facebook Messaging Service is almost equally popular among participants as shown in Figure 67.



Figure 67: Facebook messaging service use by Students & Instructors

Other popular messaging services include apps such as Viber and WhatsApp³¹, but Facebook messenger by far the most popular choice of the participants being used several times a day, while the second most popular communication service (almost equal in popularity with Facebook) is the SMS service as shown in Figure 68.

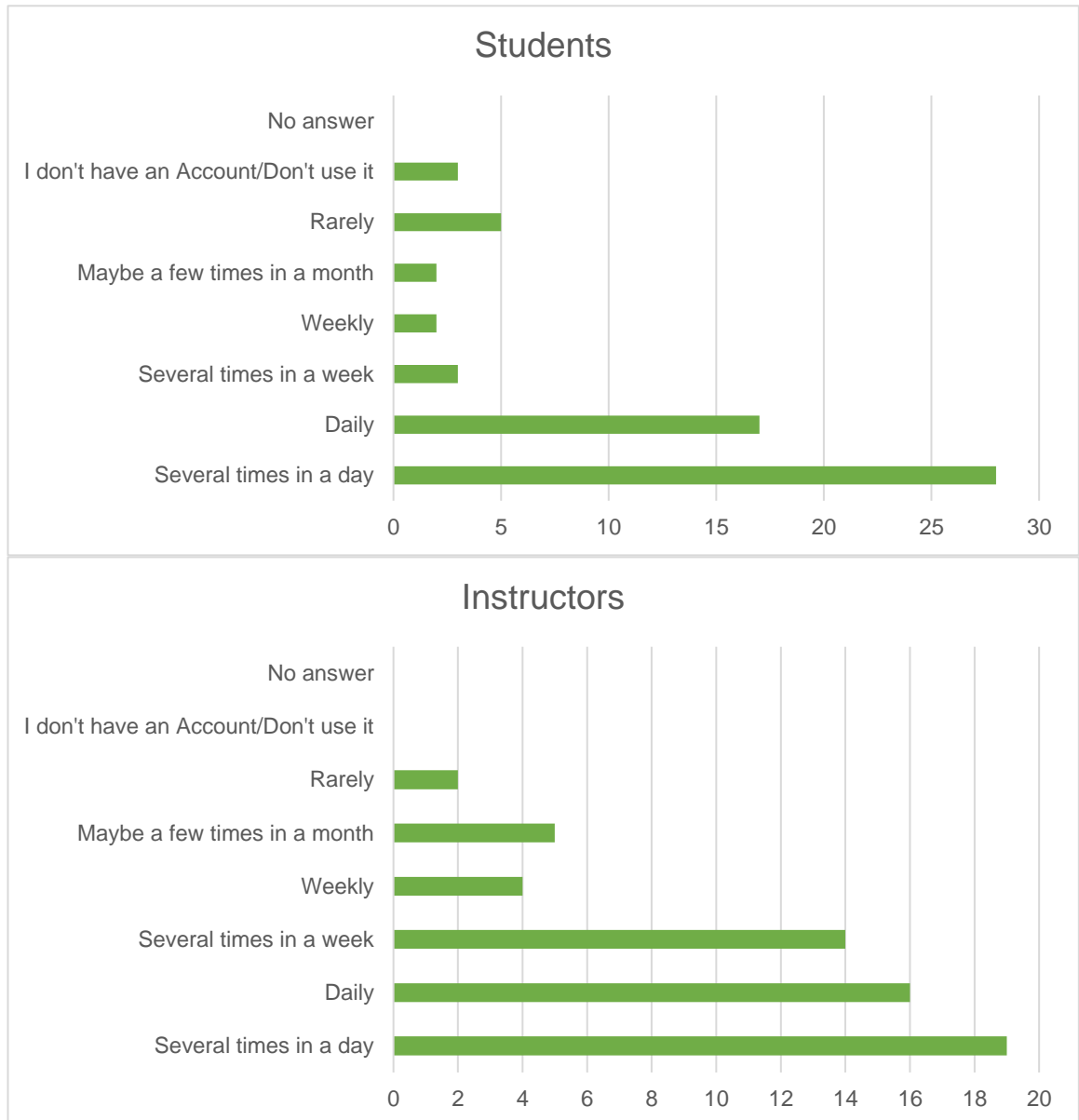


Figure 68: SMS service use by Students & Instructors

³¹ Viber and WhatsApp are communication applications similar to Skype and Facebook Messenger. Viber also offers a desktop version.

Further investigation of the survey data indicated that the most popular social network service, Facebook and especially Facebook Messaging service mostly accessed by via mobile devices by students but also by a large group of instructors as shown in Figure 69.

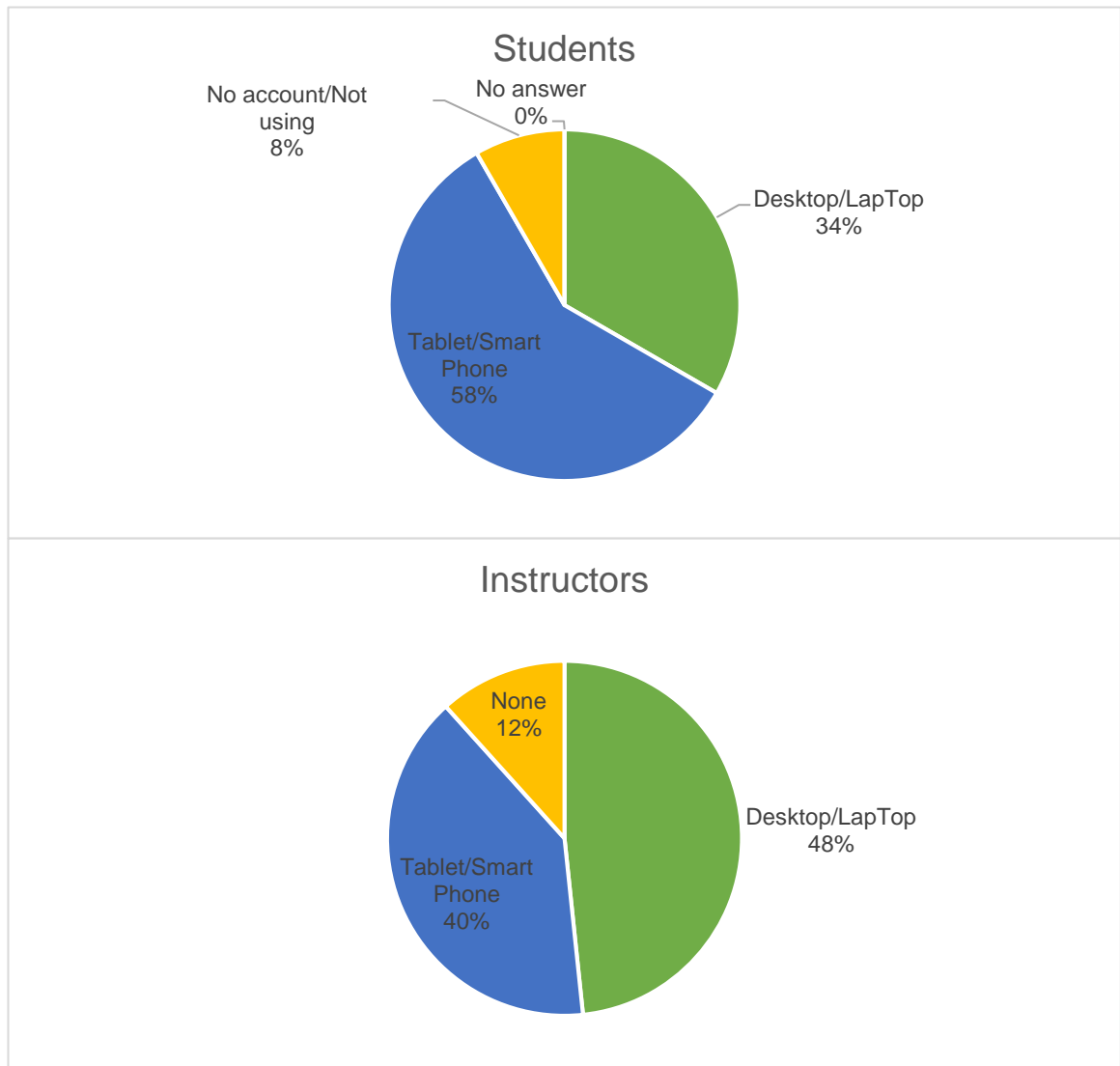


Figure 69: Facebook mobile access

As indicated by the data visualized in Figure 70, Facebook Messenger app seems to be extremely popular among students and largely adopted by instructors as well. Therefore, both students and instructors seem to have already been motivated and accustomed in the use of a real-time notification system. These findings are also backed up by the latest Kaspersky Lab report (*Kaspersky Lab Parental Control Report Reveals Chats, Games and Narcotics most Popular*

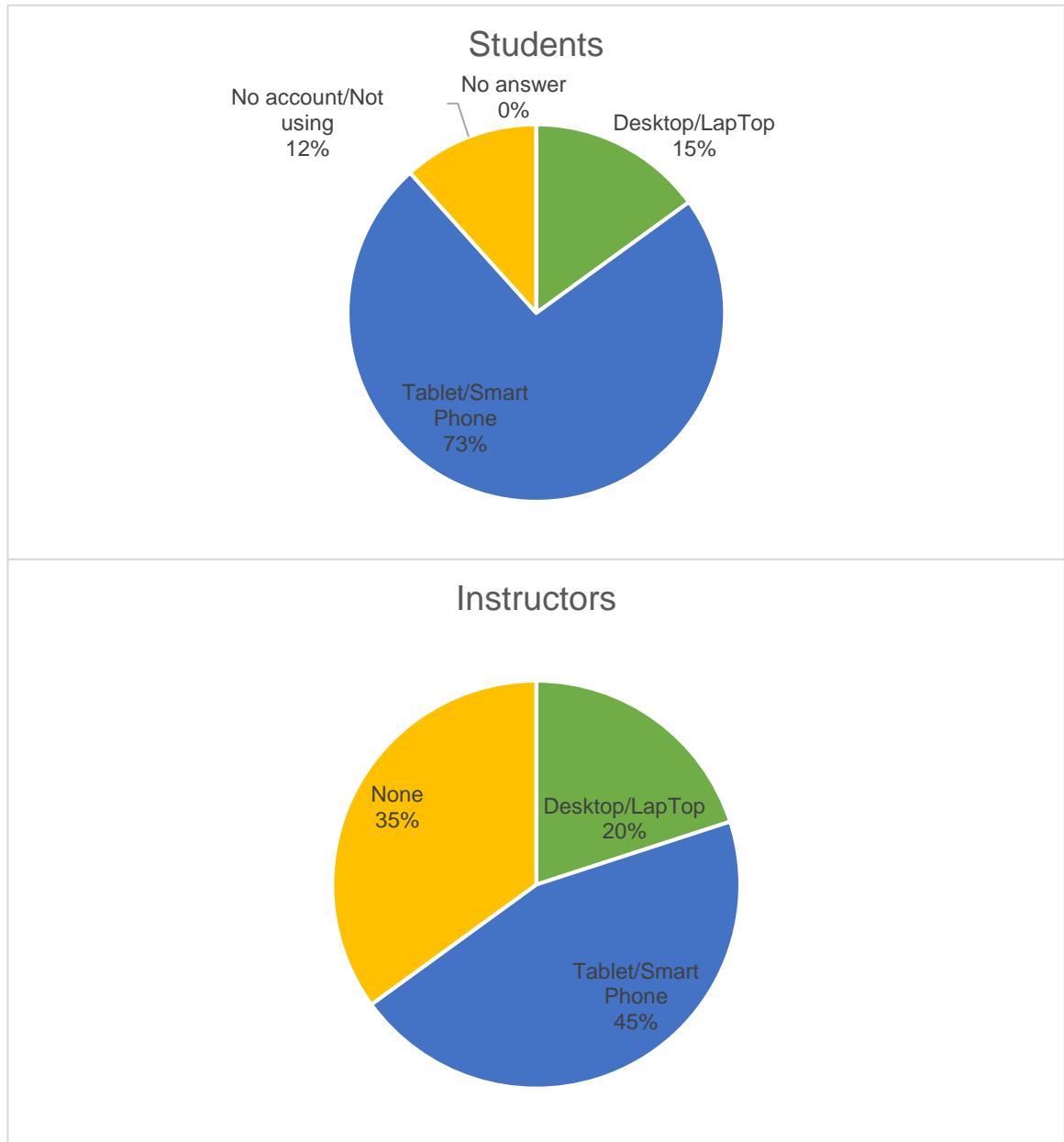
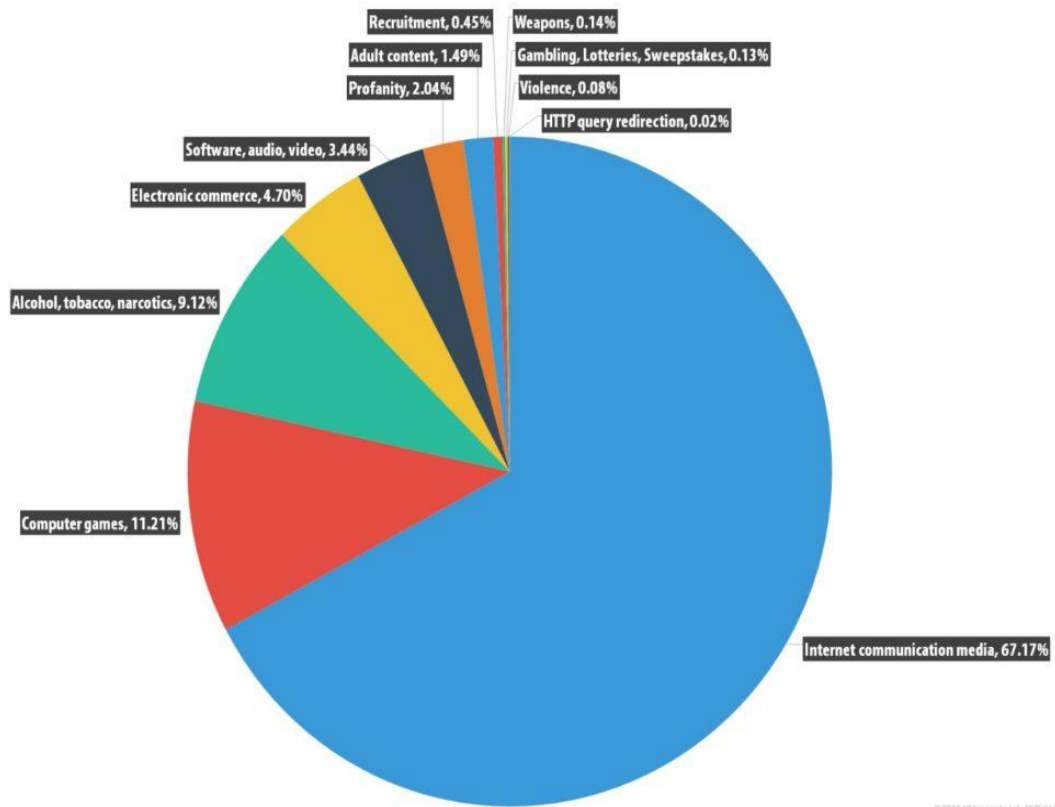


Figure 70: Facebook Messaging Service mobile access

Among Children | Kaspersky Lab, 2016) according to which, the category of Internet communication media is the most popular among students in all countries followed by the Games, Alcohol, tobacco and narcotics categories (Figure 71). These are high school students. They are the next generation of Higher Education students and the message they send is that the means of communication have shifted towards Internet communication media.



Source: (Larkina, 2016)

Figure 71: Distribution of Parental Control notifications between the 12 website categories globally, April 2015 – April 2016.

Other categories including e-commerce and videos, are found to be of much less popularity while there is no reference of an eLearning category. Hence, as a result, adding mTEL notifications and updates through personal messages or status changes would definitely increase the probability that the learning community members will see them when they will check communication media for their personal interest updates.

Based on Figure 72 both students and instructors, rarely or not at all, access Blackboard via their mobile device and therefore do not receive any class related notifications unless they use their desktop or laptop. As mentioned before, a mobile version of Blackboard exists, but due to its limitations but also complex and costly logic of connecting the user to the institutional web platform it is mostly not used. It is obvious that providing a notification service that can centrally

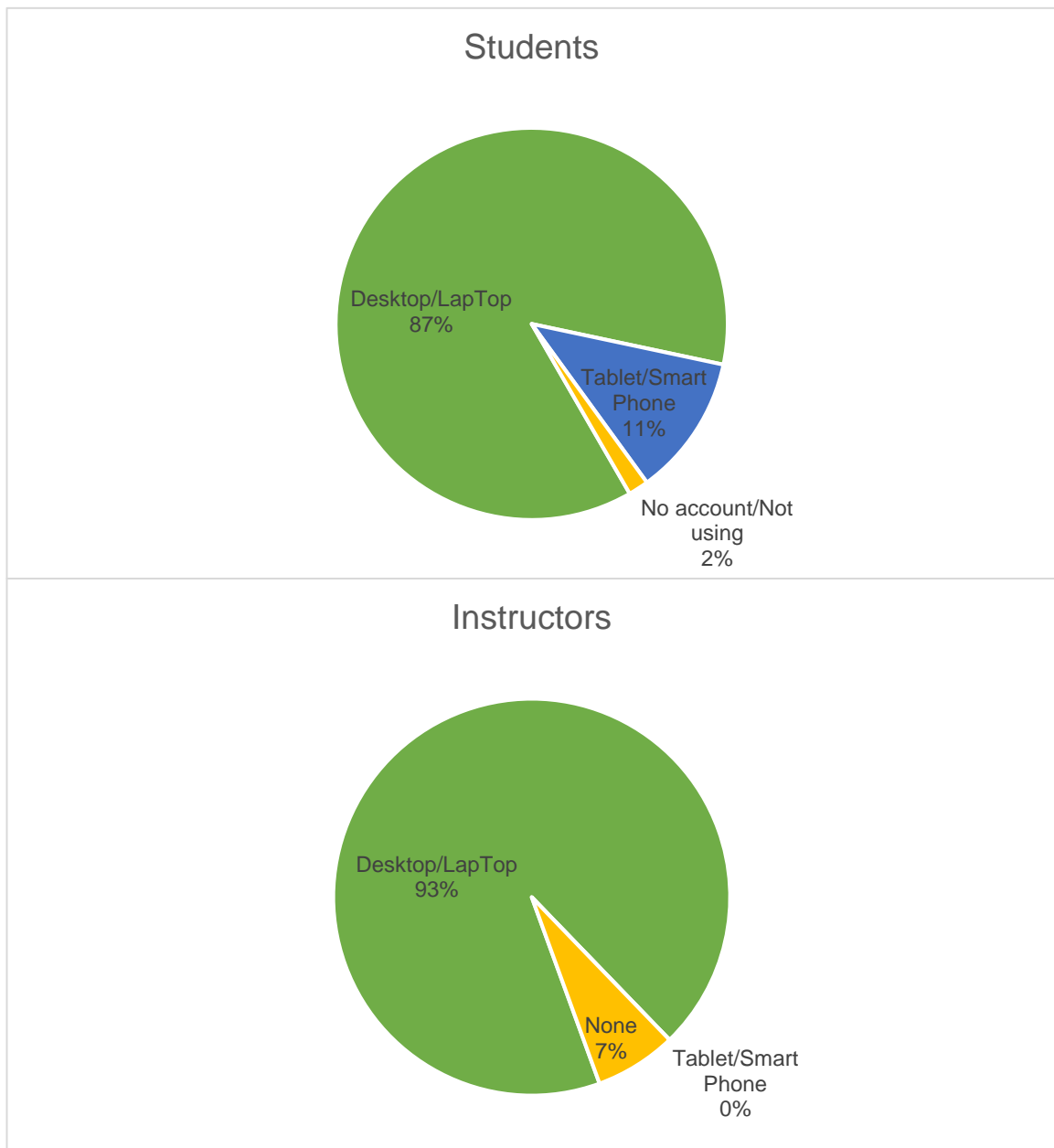


Figure 72: Preferred device for accessing Blackboard

integrate class related notifications not only from Blackboard but also from all other supplementary web services used directly at the community member device and through their favorite mobile social application, would at least increase the awareness with respect to activities and changes that occur in the implemented technologies used by a class or a learning activity.

Moreover, based on the logical assumption that the longer time someone spends in front of the screen interacting with a certain web service, the higher the probability that notifications will be noticed if made available through that service.

For that reason, participants were asked to provide relevant information of the time they spend when they visit Internet services considered by the mTEL ecosystem.

The following figures provide a visual representation of that use:



Figure 73: Time spent per access in Facebook

In Figure 73 it can be observed that 45% of students spend a significant amount of time in Facebook while some of them (10%) spend more than 2 hours in every visit.

Combining the data referring to how often students visit Facebook with the data on how much time they spend in every session, a pivot chart was created as shown in Figure 74. It is interesting to observe that the majority of students that visit Facebook several times in a day are those spending 1-3 hours in each session.

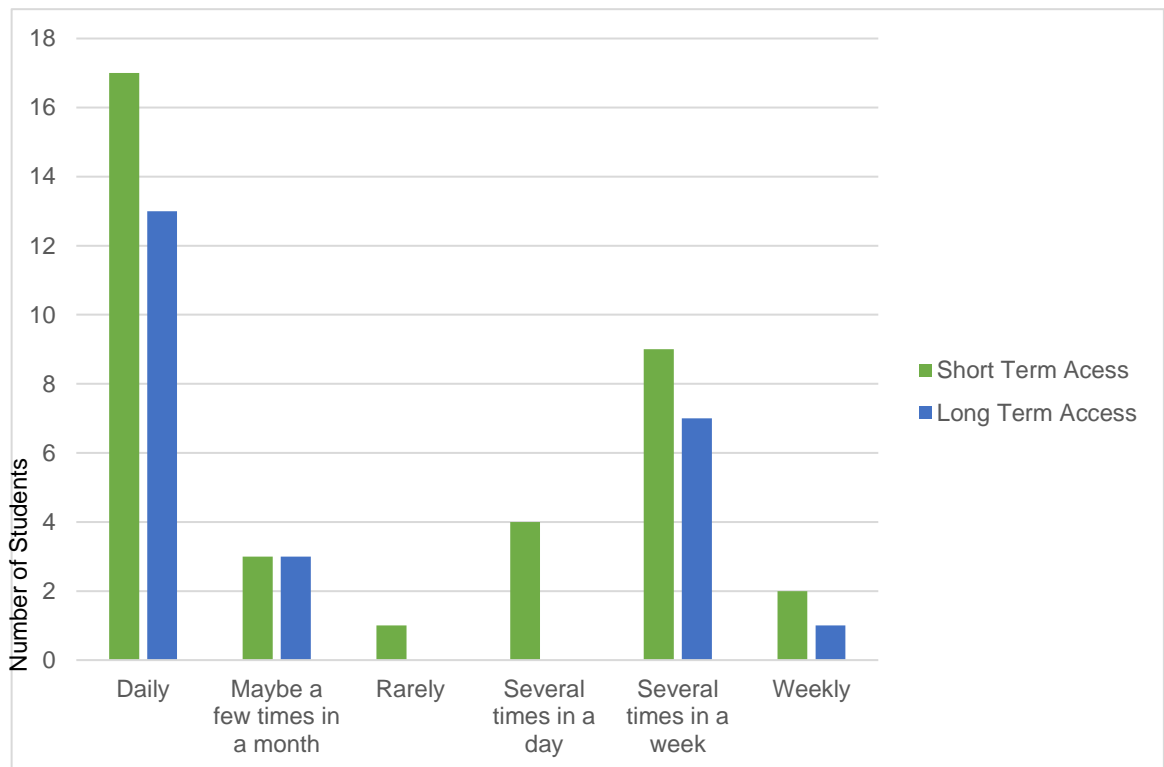


Figure 74: Correlation of Blackboard frequency of access by students and time spent per session

Furthermore, when the same pivot logic is applied on the corresponding data for Blackboard (Figure 75), it is observed that only very few students visit Blackboard several times a day, and that, limited to a few minutes, thus revealing the page

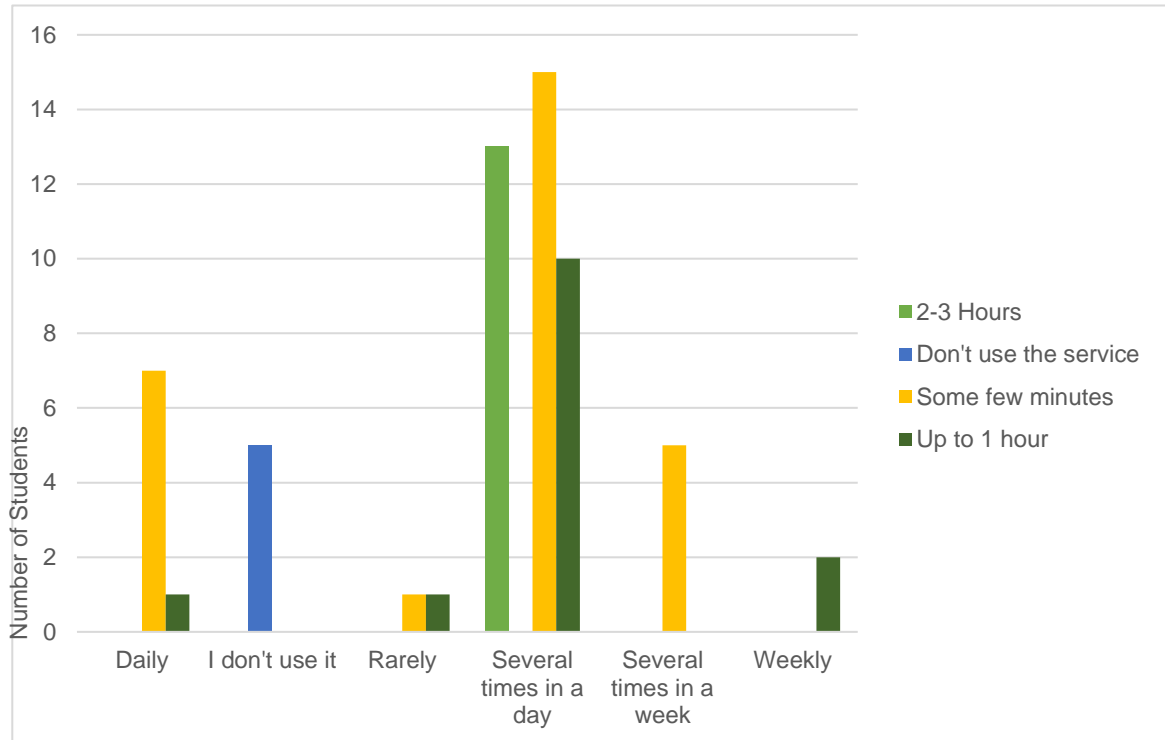


Figure 75: Correlation of Facebook frequency of access and time spent per session

view frequency/session weakness of web based eLearning platforms against social media (in our sample Facebook). mTEL eliminates this weakness by bringing Blackboard notifications in Facebook or any other preferred by the user social media.

Considering data collected from instructors on frequency of access and time spend per session in both Facebook and Blackboard, the following pivot charts were produced with similar indications with respect to Facebook and more equalized with respect to Blackboard. Instructors tend to spend less time in social media compared to students, still a large group of them spends frequently lots of time up to 2-3 hours daily as indicated at the first chart in Figure 76. Additionally, instructors seem to spend frequently more time on Blackboard as compared to students. However, this is expected since they also have the burden to develop

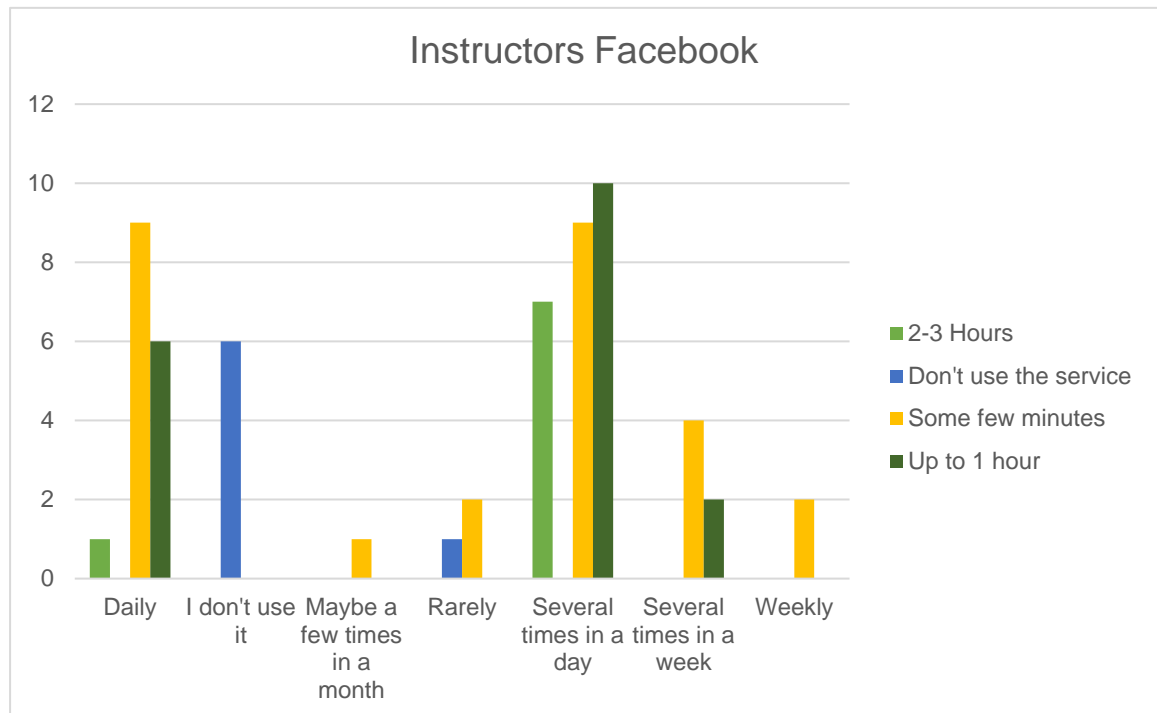


Figure 76: Correlation of Facebook frequency of access by instructors and time spent per session

eLearning content and activities which may be quite consuming in terms of time required (Figure 77).

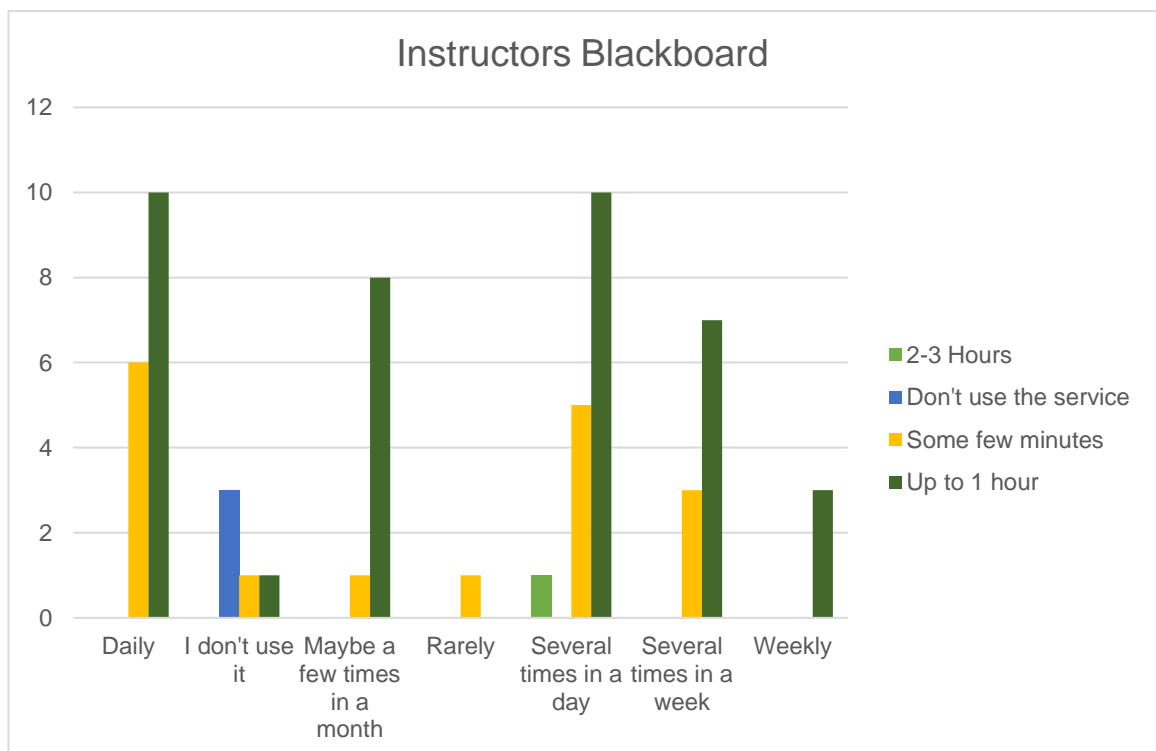


Figure 77: Correlation of Blackboard frequency of access by instructors and time spent per session

To conclude, based on the Demographics section of the survey results analysis and in contrast to older observations indicating instructors running behind students in technology at large [138], it is obvious that the technologies, the infrastructure, the experience and the culture of both students and instructors, with respect to mobile application use, provides the foundation requirements both in terms of technology and in terms of eLearning engagement needs, for mTEL to succeed in achieving its core objectives as discussed in section 5.4.1 Mobile TEL Objectives.

6.2.2 mTEL Survey Evaluation Quantitative Questions & Findings

Please evaluate the Mobile TEL functionality for aggregating updated notifications from a variety of sources (i.e. Blackboard, Facebook, Viber or Other Messaging service) all in one place.

As Figure 78 indicates both students and even more instructors believe that mTEL all in one place notification system from a variety of sources is an good to excellent feature. A small number of people are indiferent about this feature and just two instructors consider it bad, which possibly indicates people's natural

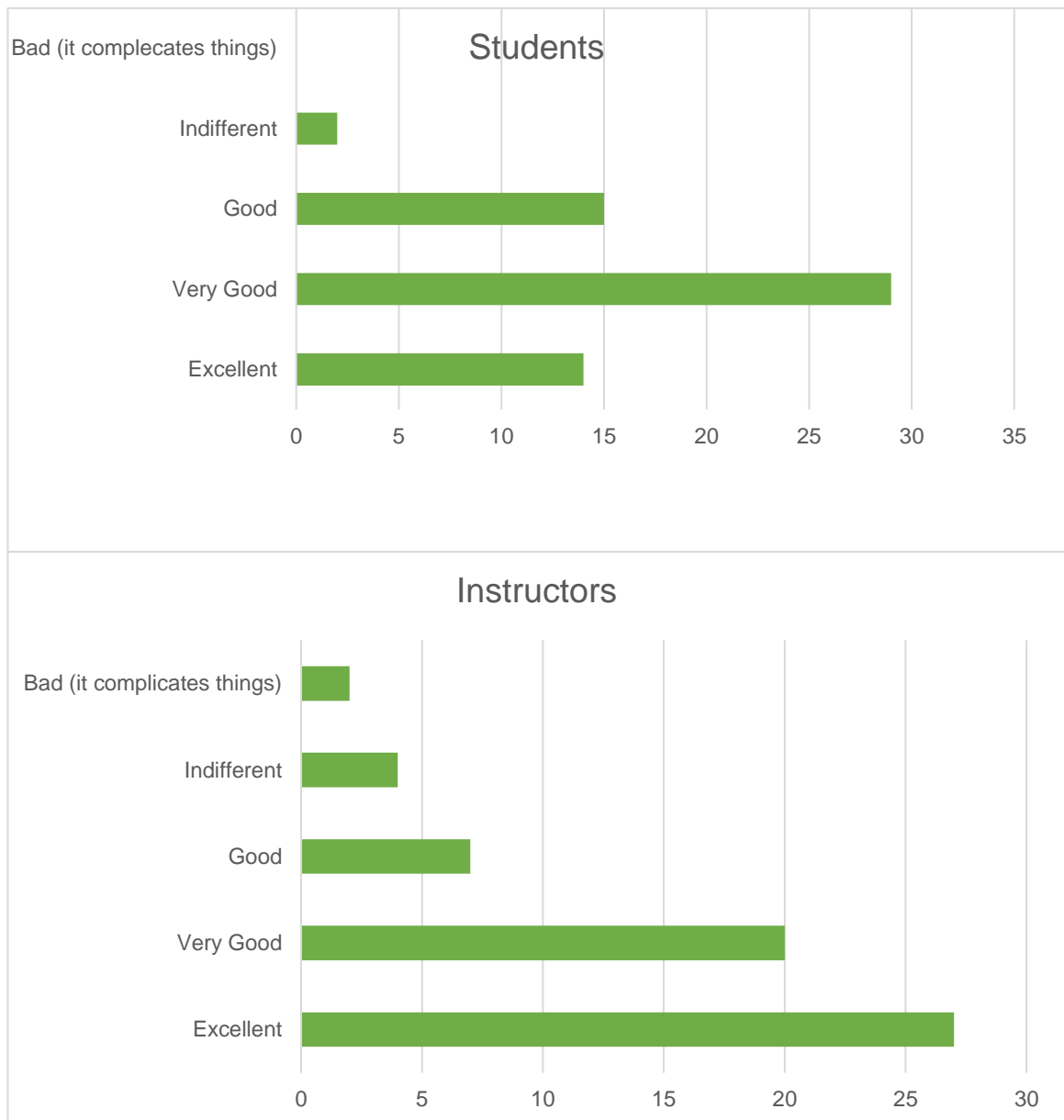


Figure 78: mTEL aggregating updated notifications from a variety of sources feature

resistance in change, a common reaction (Kotter and Schlesinger, 1979) to newly introduced things including technology. Although, the percentage of instructors having a negative opinion about mTEL is significant, it can be explained as resistance to change to new methods by instructors. This conclusion was derived as the outcome of short empirical sessions held with random members of the faculty in order to explain their negative opinion. Instructors reported that they were under the impression that the held survey was a way to actually introduce mTEL as part of the institution's elearning strategy without any prior notification or involvement on their behalf. Therefore they reacted negatively. Since education and communication are common ways to deal with the resistance of change (Kotter and Schlesinger, 1979), institutions may consider this when implementing their communication strategy on the use of mTEL. Additionally, some training, by means of a hands-on presentation of the app, may resolve confusions leading to the misbeleif that mTEL may complicate things.

Do you think that students will be assisted not to lose any eLearning updates if they use Mobile TEL? (Student response)

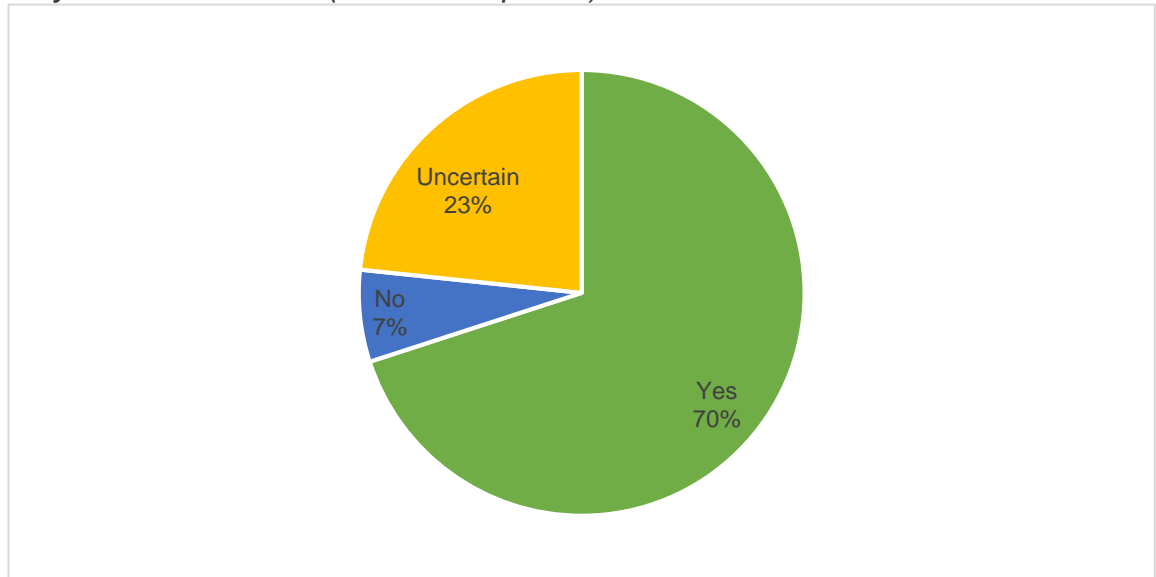


Figure 79: Will students be assisted not to lose any eLearning updates if they use Mobile TEL? (Student opinion)

Based on the responses, a large number of students believe that mTEL will assist them with being updated on class activities in case they do not access formal means of communication (like Blackboard notifications and mail which have been proven to fail updating users). So students confirm that mTEL offers a solution to the low level of up datedness currently offered by web-based platforms.

Do you think that students but also instructors will be assisted not to lose any eLearning updates if they use Mobile TEL? (Instructor response)

In Figure 80, instructors offer their opinion upon the impact of mTEL to them but also their consideration upon the impact of mTEL to students. Again the majority positively believes that all members of the learning community, instructors and students, will be assisted not to lose any learning related activities and updates if they are using mTEL.

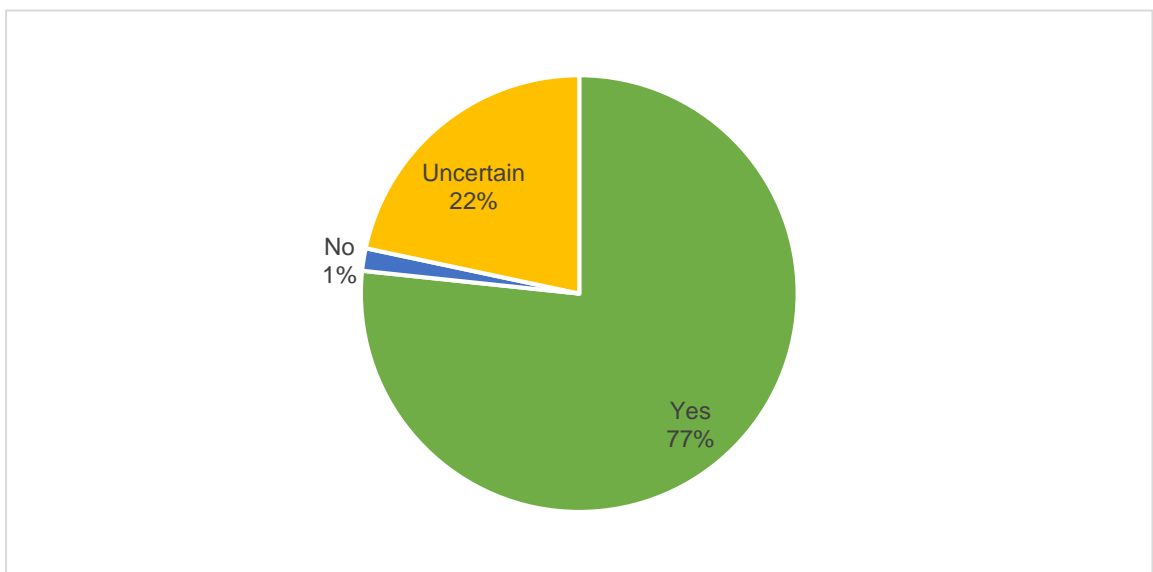


Figure 80: Will students but also instructors be assisted not to lose any eLearning updates if they use Mobile TEL? (Instructor opinion)

How would you evaluate the Mobile TEL interface based on the demo screens you have seen at the presentation?

From Figure 81, we derive the conclusion that mTEL user interface was successfully approved by the majority of the participants, as an easy (either “easy” or “very easy”), similar to other commonly used applications.

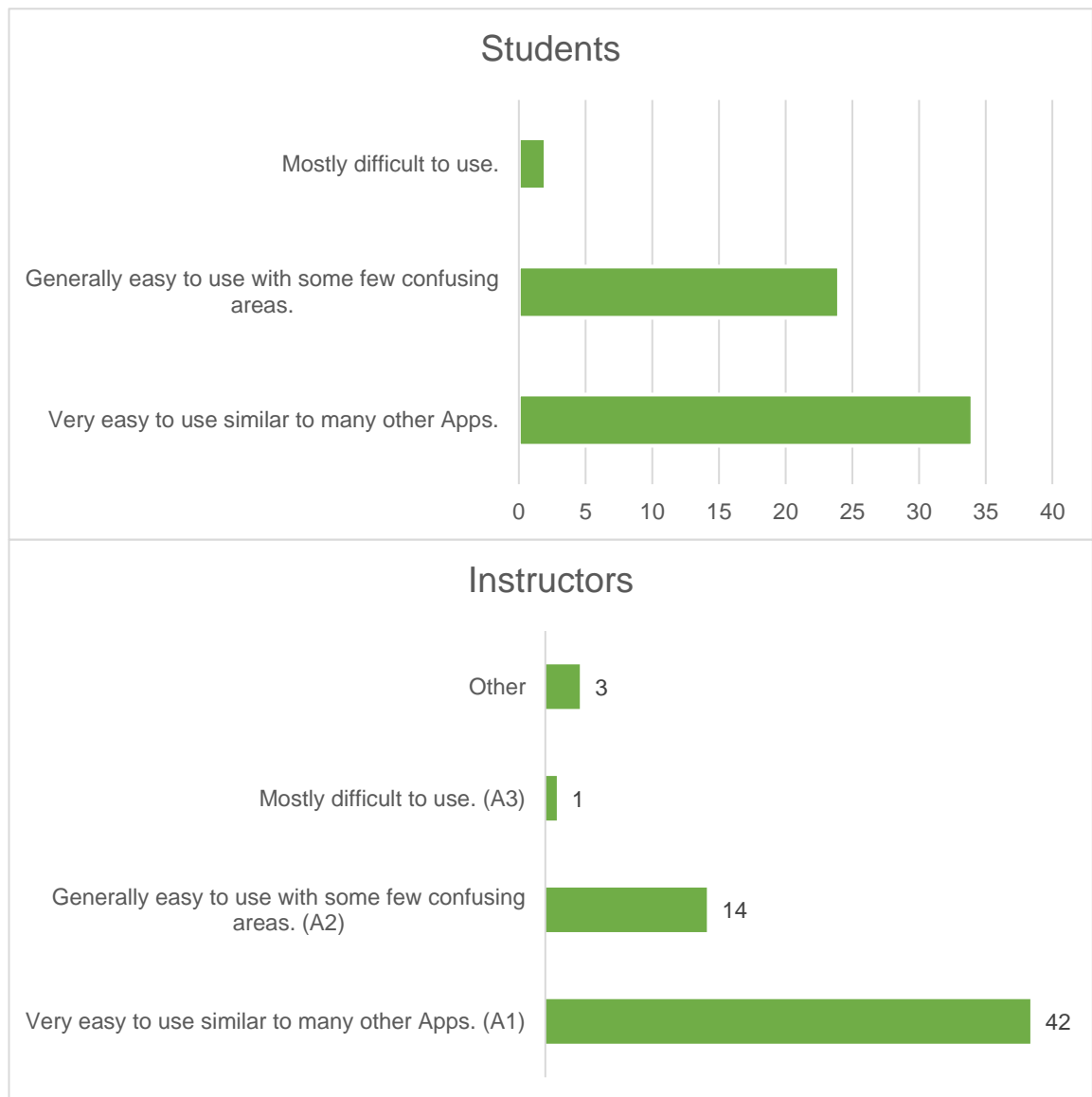


Figure 81: Mobile TEL interface evaluation review by students & instructors

The fact that Mobile TEL uses existing installed mobile apps makes it a very light

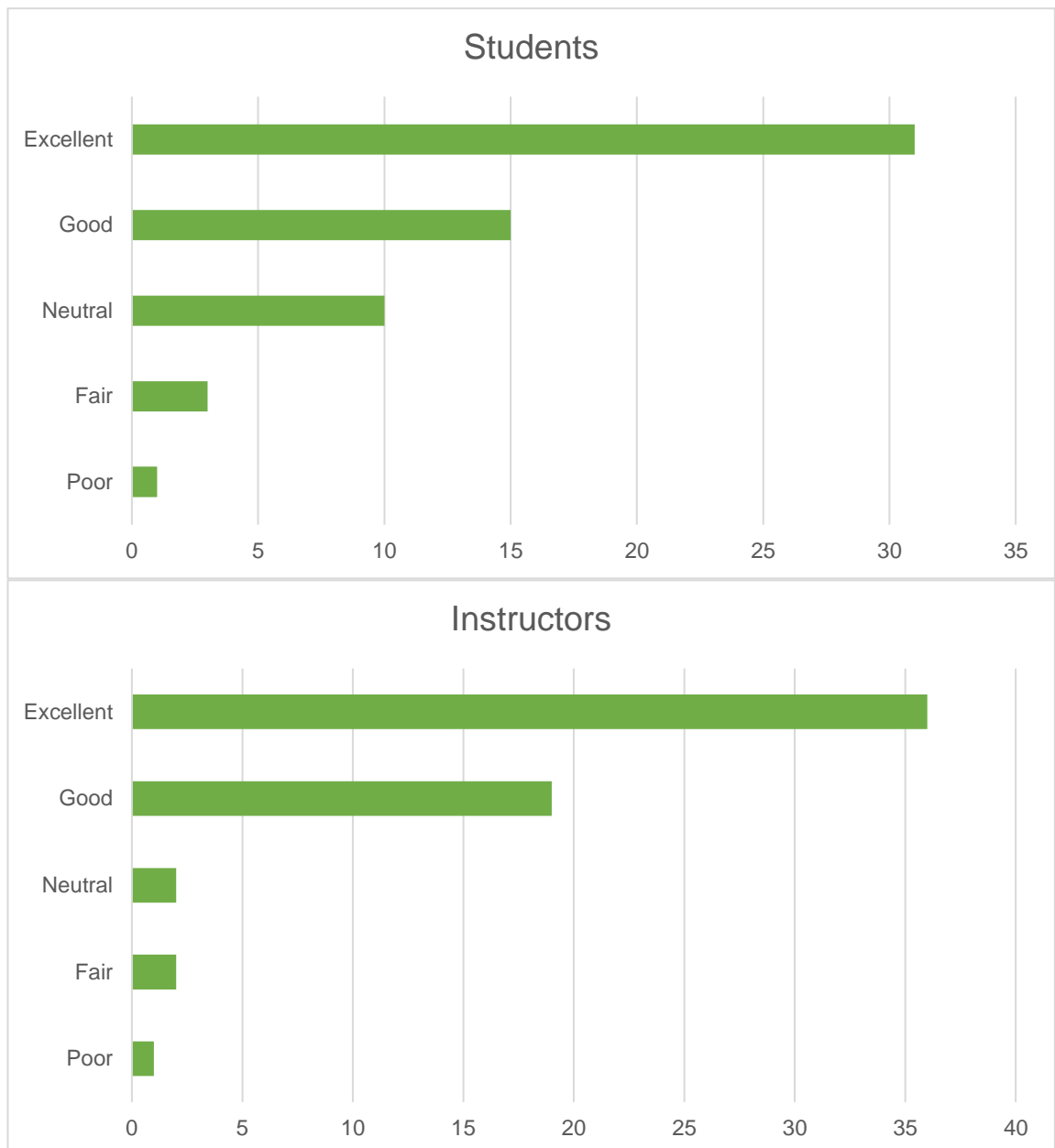


Figure 82: Evaluation of the fact that Mobile TEL uses existing installed mobile apps makes it a very light application that does not burden your mobile device.

application that does not burden your mobile device. How would you rate Mobile TEL based on this feature?

Based on Carrols analysis of power consumption in a smartphone (Carroll and Heiser, 2010), the use of the device's display, CPU usage, WiFi and GPRS (provided by the GSM subsystem) network use, audio and video playback results in high battery consumption.. Mobile devices consume the least of energy when

they are suspended or idle. mTEL mostly acts as a ghost app expecting notifications to be pushed from the server-side part of the application which does not burden the mobile device at all. Based on its design, (discussed in section 6), mTEL, even when active, (e.g. a user checks his notifications), it uses the CPU, the memory and the network in a light way, since all it does is limited to transferring and displaying short text messages and informing about class updates. All energy draining activities are performed by the already installed native applications thus making mTEL consumption insignificant, compared to other popular and frequently active applications users prefer to use, like Facebook, etc. It is verified by the vast majority of the survey participants that the low energy consumption ability of mTEL operation is primarily an excellent characteristic.

Mobile TEL permits transferring content from the mobile device in which it is installed to any more appropriate device in the premises like a smart TV or Projector. How would you rate this feature?

The majority of the survey participants, agree that the mTEL feature that permits transfer of content, especially streaming video, at optimum bit rate to more appropriate smart devices on premise, is a preferable feature for implementation since permits more convenient access in any place the learner may be as long as smart devices are available. Indeed, this is another feature that is widely welcomed by the survey participants with instructors being the most enthusiastic group, as indicated in Figure 83.

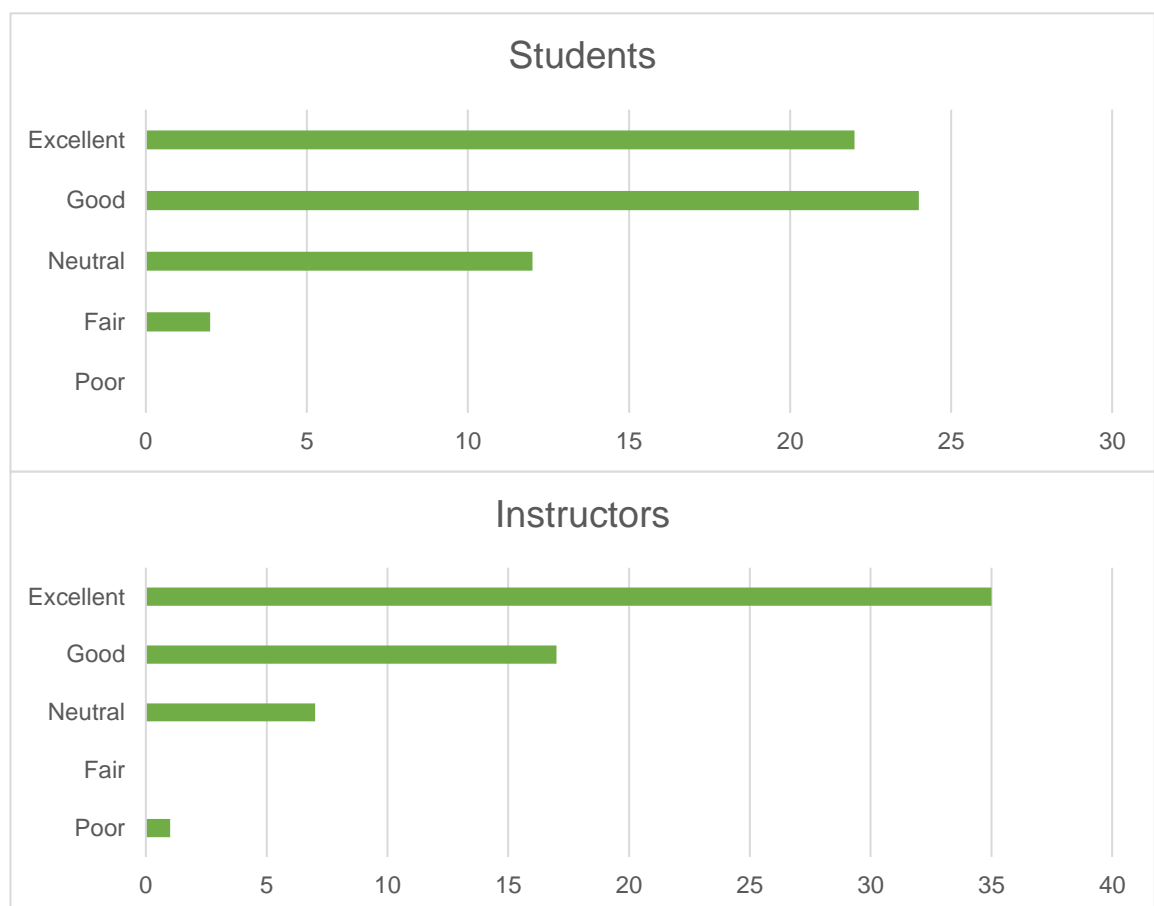


Figure 83: Evaluation results for transferring content from the mobile device in which it is installed to any more appropriate device in the premises like a smart TV or Projector feature

Do you think that Mobile TEL Voice command system will assist visually challenged people?

Based on Figure 84 it is clear that the majority of participants (especially in the case of instructors) agree that mTEL offer significant assistance to visually challenged people. This is considered an extra to the core specification feature, which is welcomed by most evaluators.

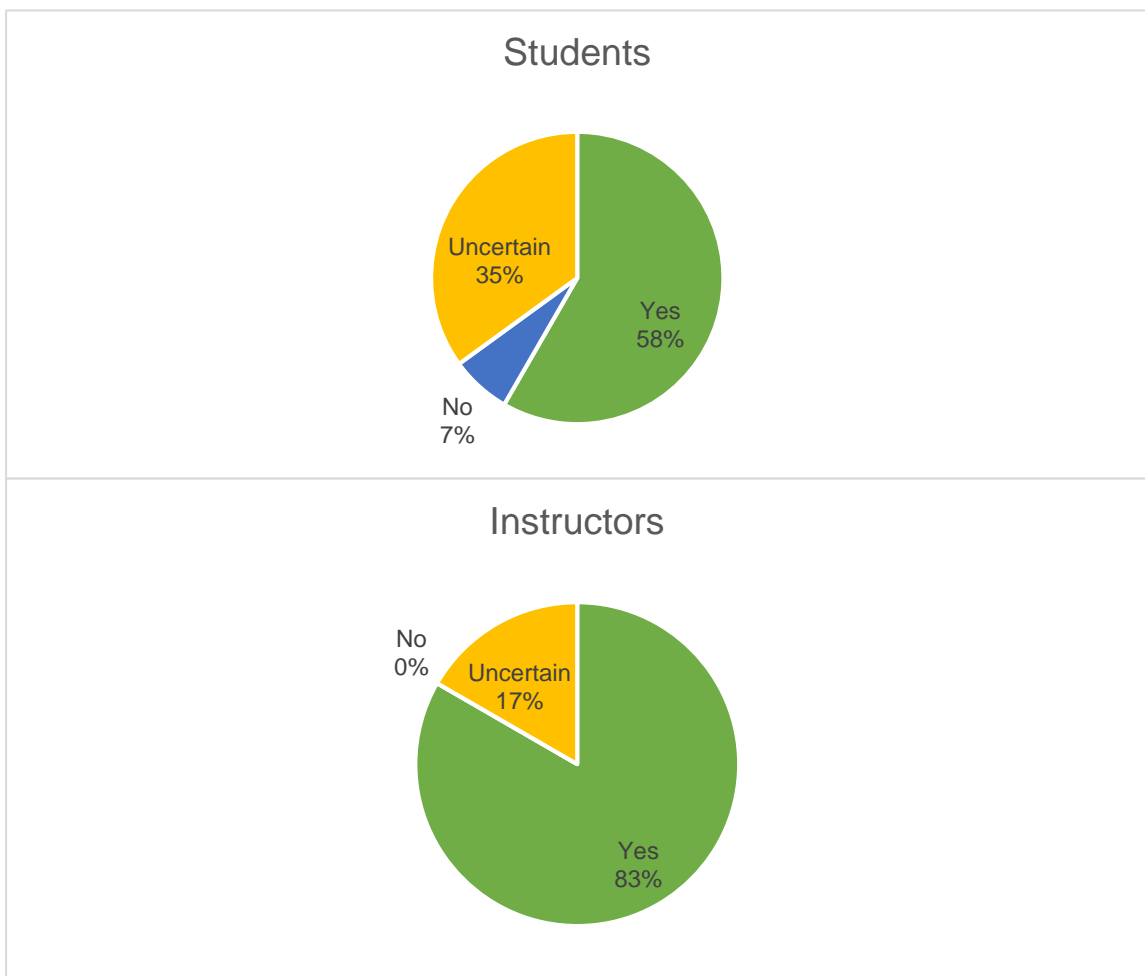


Figure 84: Voice command system feature evaluation in assisting visually challenged people

Will Mobile TEL Voice Command System enabled to interact with the application by speech may assist in working with it in parallel with other activities?

The vast majority of instructors positively believes that the use of mTEL Voice command system, may reduce the time required to interact with eLearning activities via the application since they will be able to do so without the use of their hands in parallel with other activities like cooking (Figure 85).

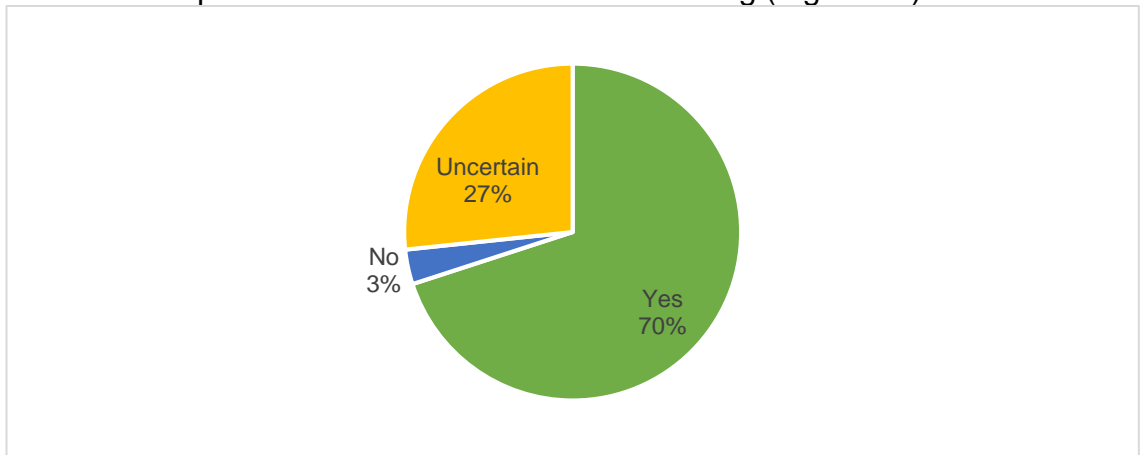


Figure 85: Evaluation of Voice Command System assisting interacting with activities in parallel with other engagements

*Will Mobile TEL Voice Command System assist in enhancing the following areas?
[Visually challenged people may have fast access in updating eLearning content
and communicating with students that otherwise would be difficult, time
consuming or even impossible at such level of integration]*

In addition to Figure 85, instructors' majority believes that mTEL will speed up the update process of eLearning content and communication with students because of the embedded use of the Voice Command system as shown in Figure 86.

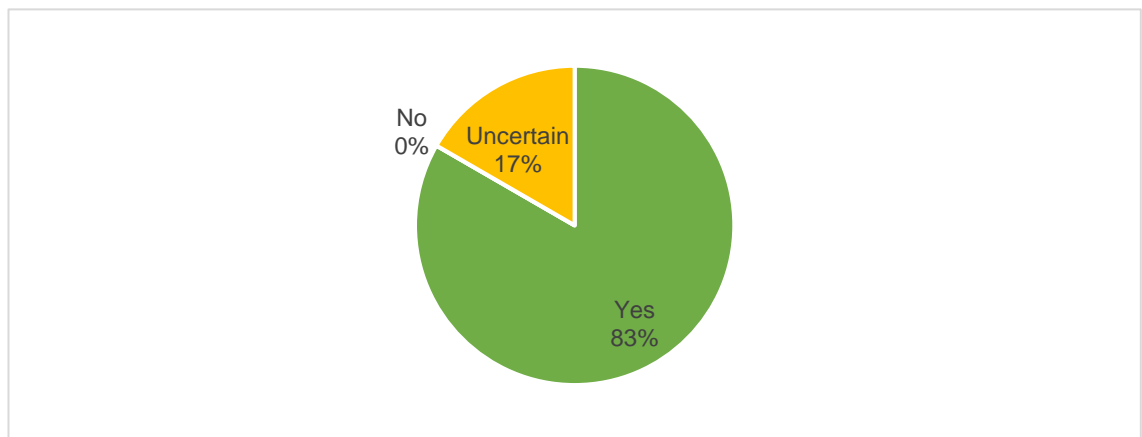


Figure 86: Mobile TEL Voice Command System assist in enhancing interactivity for visually challenged people

A survey on eLearning web applications like Blackboard indicated that a quite large number of instructors does not use them effectively but mainly as course documents repository. Reasons may include lack of time, lack of technical expertise which may result to receiving outdated communication that results into demotivating students to optimally use eLearning web Applications. Please evaluate if the Mobile TEL will have a positive influence to the above challenges of web based eLearning applications. Mobile TEL best utilizes time so Instructors may do more in less time and sometimes in parallel with other obligations.

Once again the majority of instructors has a positive opinion about the influence mTEL will have with respect to leading students, not only to use eLearning platforms as just a content management system, but also assist them to get more involved with other on-line eLearning activities. This will be done by promptly informing them on related updates and by reducing the time instructors invest in creating these updates. Thus, mTEL enables them to closely monitor and respond to these activities in less time compared to accessing the web-based institutional LMS (Figure 87).

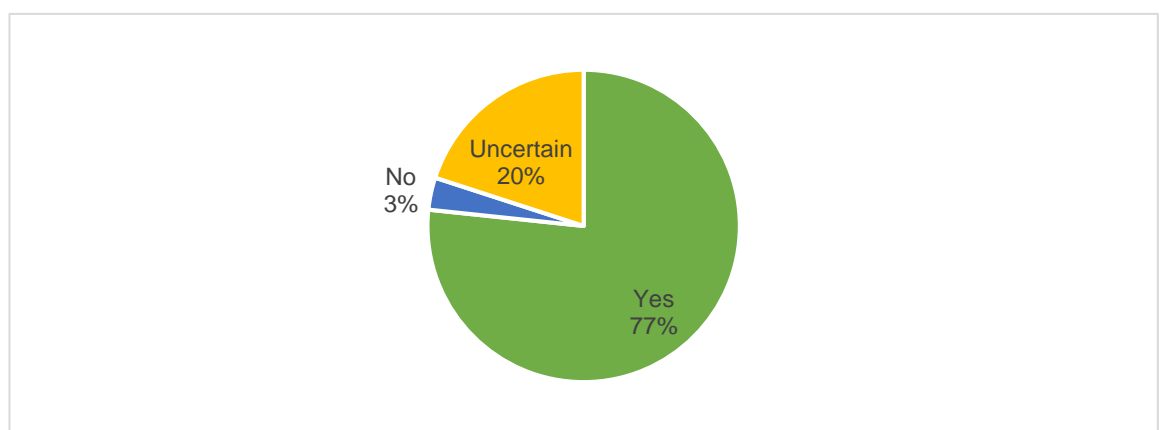


Figure 87: evaluate if the Mobile TEL will have a positive influence to the above challenges of web based eLearning applications

Mobile TEL is very easy to use also because it reduces technical expertise required to manage eLearning application.

Based on Figure 88, the majority of the instructors seem to welcome mTEL's easiness through which they can manage and interact with the institutional eLearning application without requiring any special technical expertise except the one they already have through using other popular mobile apps. Moreover, they believe that mTEL simplifies the process through by-passing the complex institutional LMS, transferring the interactivity process either through the minimally simple mTEL interface or through other popular services with which are already familiar (e.g. Facebook), as indicated at the Demographics Section in

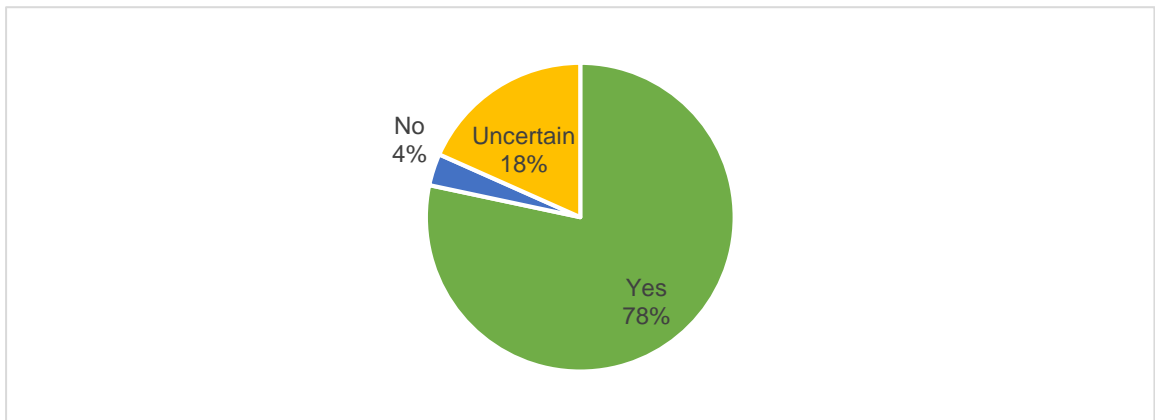


Figure 88: Evaluation of the reduction of technical expertise required to manage eLearning apps (Instructors)

6.2.1 Demographics (Students and Instructors).

How would you evaluate the Mobile TEL interface based on the demo screens you have seen at the presentation?

Based on Figure 89, only 2 of the participating students, believe that mTEL User Interface is mostly difficult to use. Most students believe that it is very easy and similar to other apps they use while some believe that although easy, there may be a few confusing areas. That is expected since evaluators only had the chance to see screen snapshots that are not completely present the functionality of the interface. A working prototype would have resolved this problem.

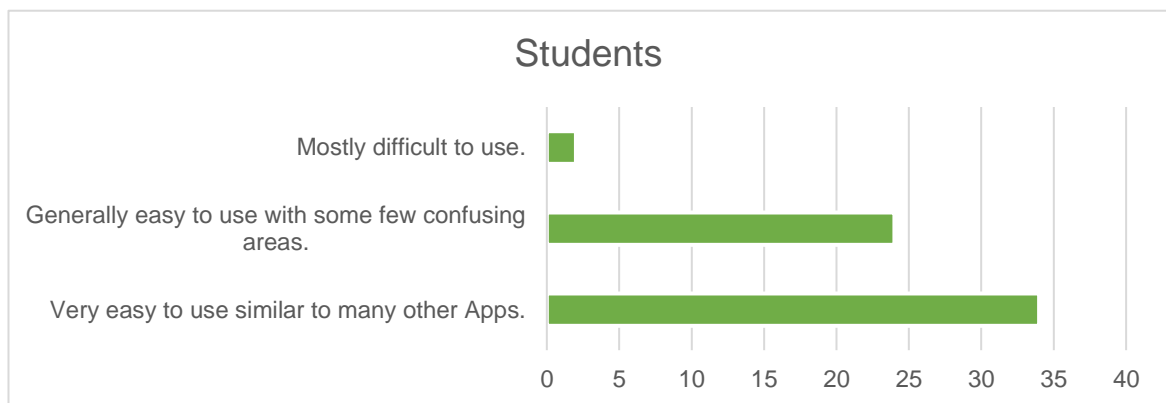


Figure 89: Mobile TEL interface evaluation by students

Mobile TEL will maximize the communication potential between instructors, students and eLearning apps activities.

Based on Figure 90, the majority instructors believe that mTEL will maximize the communication potential among the members of the learning community, by reducing the time and expertise requirements needed otherwise to update and communicate changes on content and activities at the institutional LMS.

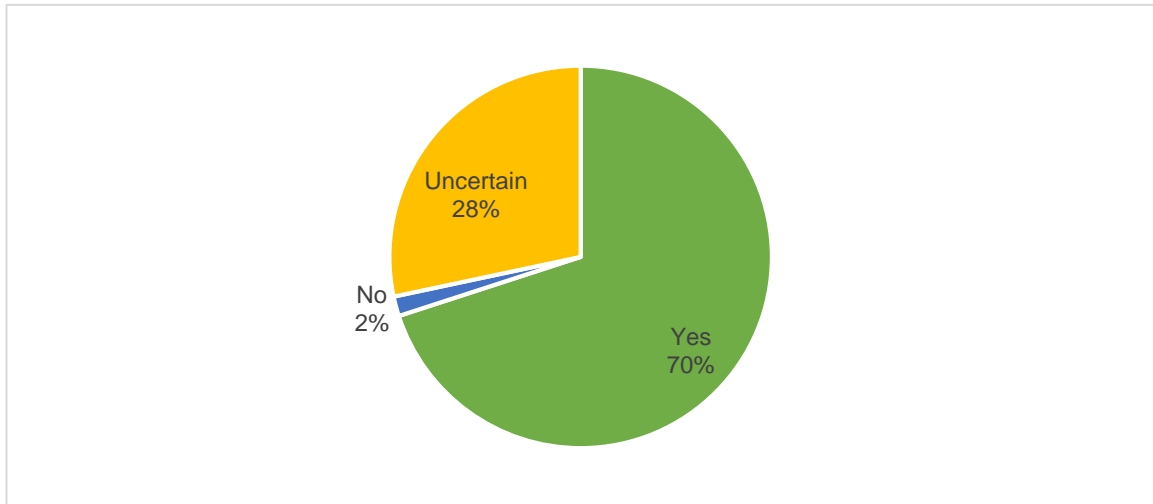


Figure 90: Evaluation of communication potential between instructors, students and eLearning apps activities by instructors.

Will students be more updated on web based eLearning activities since they will be receiving notifications through their mobile devices social media and mobile apps without requiring visiting the eLearning site?

The vast majority of students strongly believes that mTEL notifications and the feature of the application to link notifications on demand by invoking the updated content or activity through the native related application, will result in higher up datedness on active eLearning content and activities (Figure 91).

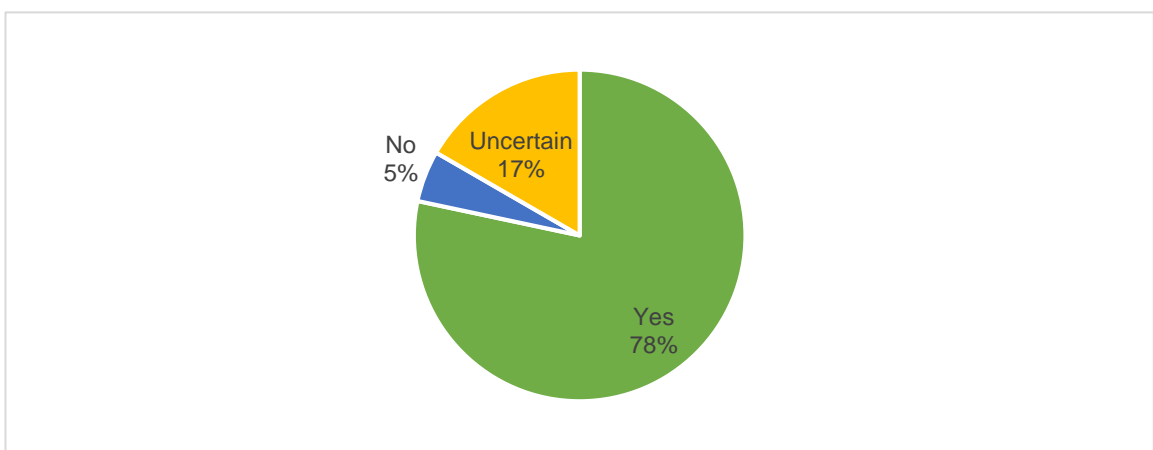


Figure 91: Students are asked if they will be more updated on web based eLearning activities due to mTEL's notifications

Mobile TEL aims to notify students and instructors in alternate ways to that of web based eLearning applications. Do you think that more updated students may become more active on eLearning activities?

Figure 92, shows that 63% students also believe that increased awareness on eLearning updates will assist them to become more active on eLearning activities confirming the importance of mTEL's notification system.

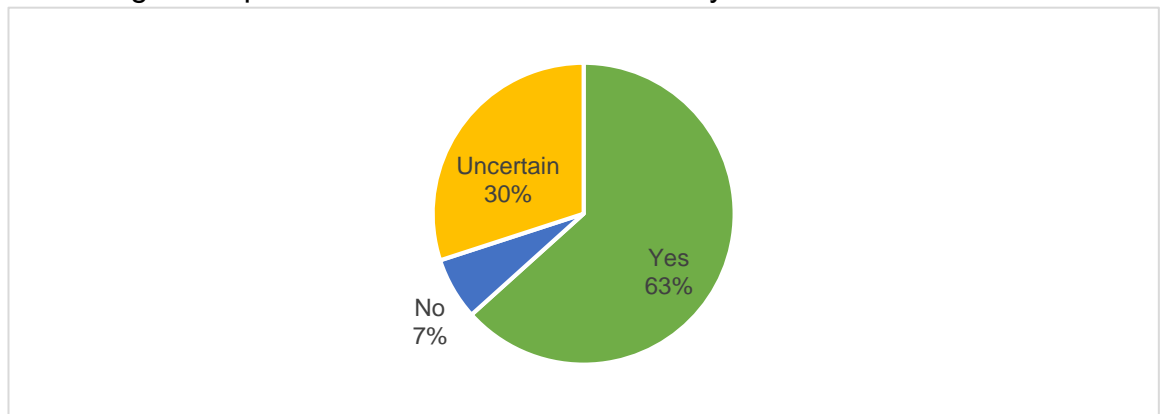


Figure 92: Will more updated students may become more active on eLearning activities? (Students' Opinion)

Being able to get updates and directly interact through Mobile TEL to the course's eLearning web based application but also other apps and students and instructors without geographic and time restrictions, will assist your learning?

According to Figure 93, most students also believe that mTEL's feature providing them with the ability to directly interact to updates as they occur via the application, will assist their learning. Although the uncertain population is minority

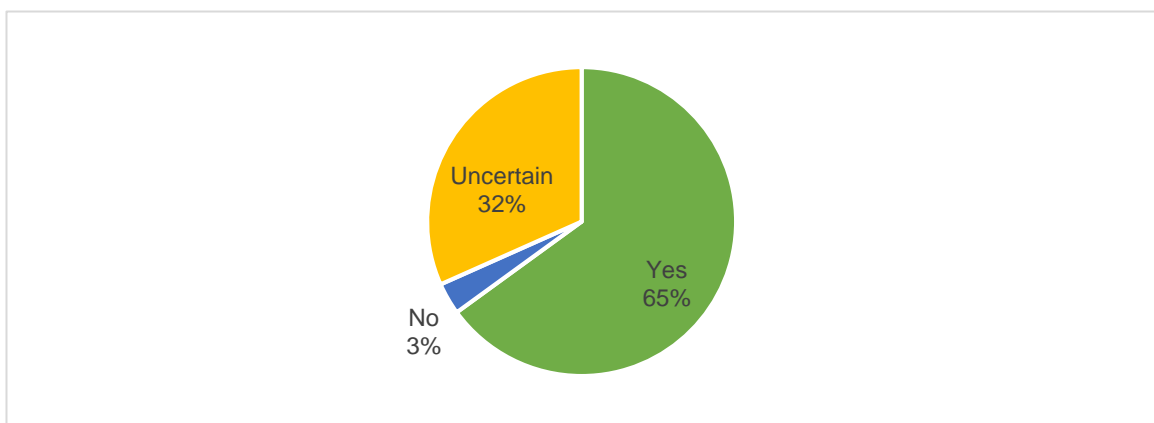


Figure 93: Being able to get updates and directly interact through Mobile TEL will assist your learning (Students' Opinion)

considerable percentage, it is justifiable since the participants are being asked to pose an opinion based on a presentation of the application without the ability of hands-on practice. However, the response shows that the majority is positive on the idea of the direct interaction ability of mTEL since it is obviously saves time and is navigationally efficient mainly in the sense that the user needs not manually switching to the updated application or site and then having manually to locate the updated content or activity. Besides, this is a successfully implemented feature in other popular applications, like a hyperlink in an email or an interactive notification in Facebook.

The fact that eLearning users using Mobile TEL through their mobile devices to stay updated of changes in eLearning content and activities is a major improvement for Technology Enhanced Learning.

In the above question (Figure 94), the majority of instructors , with only 6 objections, recognises mTEL as a major improvement for Technology Enhanced Learning. This opinion comes from a group of participants with various disciplines and backgrounds and includes people with no technical expertise (i.e. from liberal arts and humanities) but also ones with advanced technical orientation (i.e. instructors from Information Technology and the Management of Information Systems). From this classification, it can safely be assumed that the mTEL contribution to eLearning technology is widely accepted and recognised by the Academic community of the survey participants.

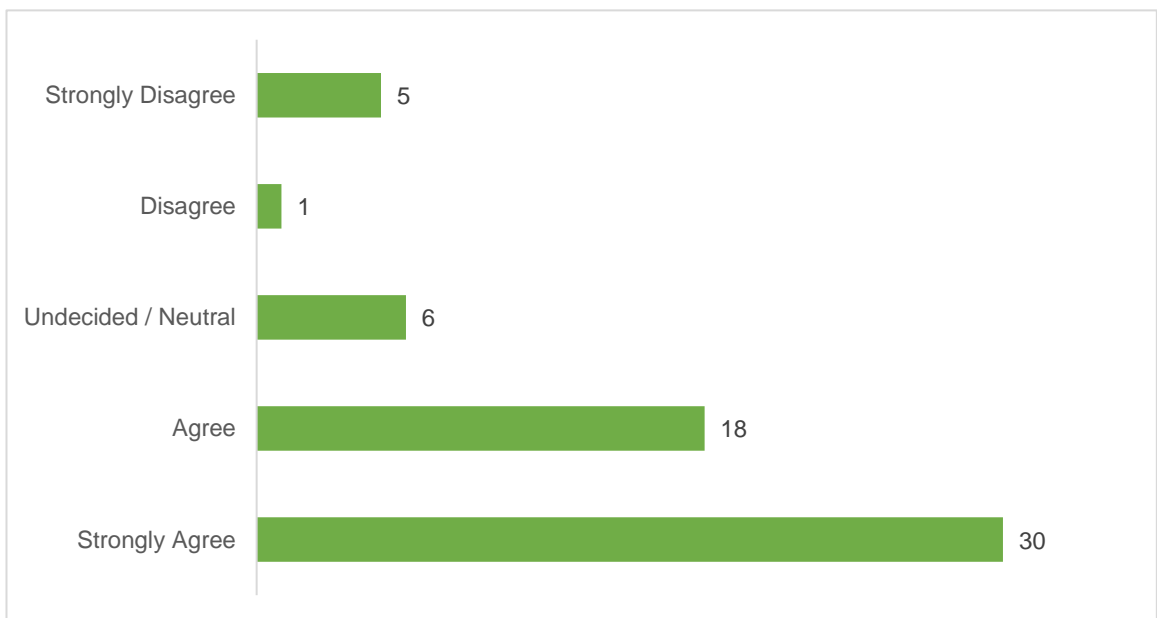


Figure 94: Is mTEL notification system a major improvement for Technology Enhanced Learning? (Instructors' Opinion)

Additionally, the fact that eLearning users using Mobile TEL through their mobile devices are able to directly update and interact with eLearning activities without entering the institutional eLearning platform (i.e. Blackboard), is a major improvement for Technology Enhanced Learning.

Moreover, instructors, based on Figure 95, widely recognize mTEL's ability to directly access, update or interact with LMS activities, as a major improvement on Technology Enhanced Learning. This allows to draw the conclusion that since there are at least two major features of the application highly recognized as major improvements by the academic community, mTEL is an innovative novel prototype that highly contributes to eLearning and Higher Education objectives.

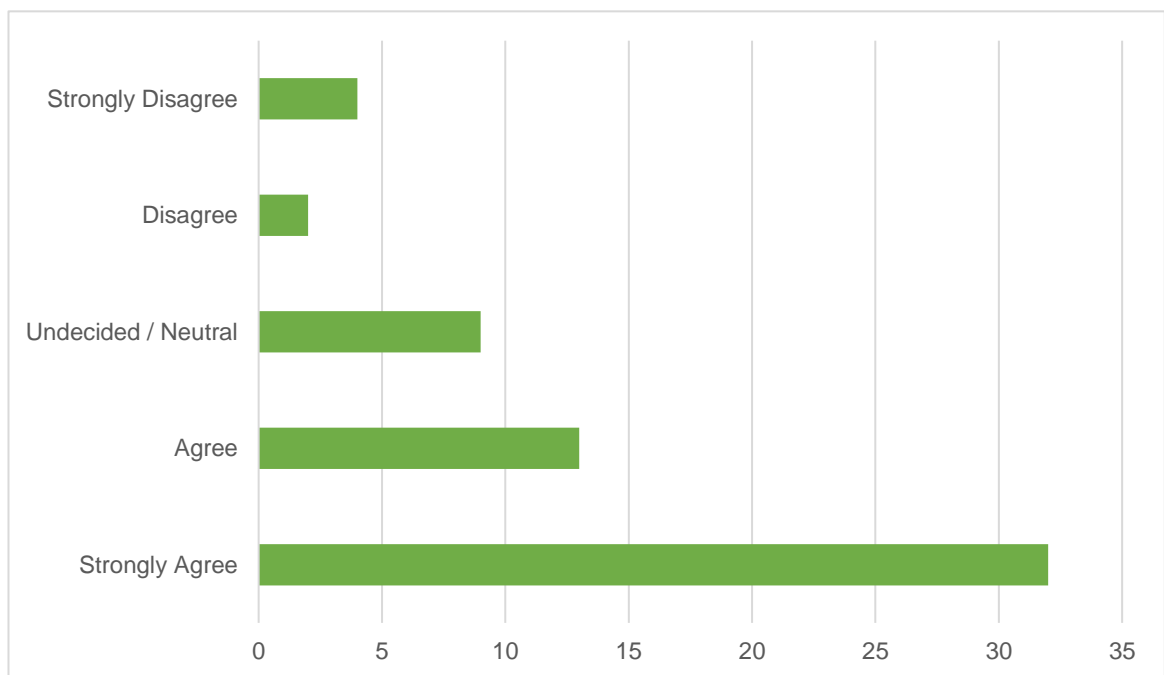


Figure 95: Is mTEL direct interaction with LMS a major improvement for Technology Enhanced Learning? (Instructors' Opinion)

The next two questions are quite critical and important. The first one addresses the effect of the app towards increasing the engagement of the members of the eLearning community. The second asks the survey participants to overall evaluate the mTEL application in terms of increasing the interactivity between the members of the eLearning community. Increasing the engagement may produce

more updated and informed members, but increasing the interactivity, is also a requirement to initiate the engagement with constructive learning activities, which is an important goal of eLearning applications. In order for interactivity to increase, updated members about changes in eLearning activities is also a prerequisite. Thus, indirectly, this response, positively empowers mTEL's notification system.

Do you believe that Mobile TEL will assist in increasing the engagement of Students to eLearning?

According to the majority of the both students and instructors (as shown in Figure 96), mTEL is positively considered to increase the engagement of students to the institutional web-based eLearning platform . Students seem to be stricter in their

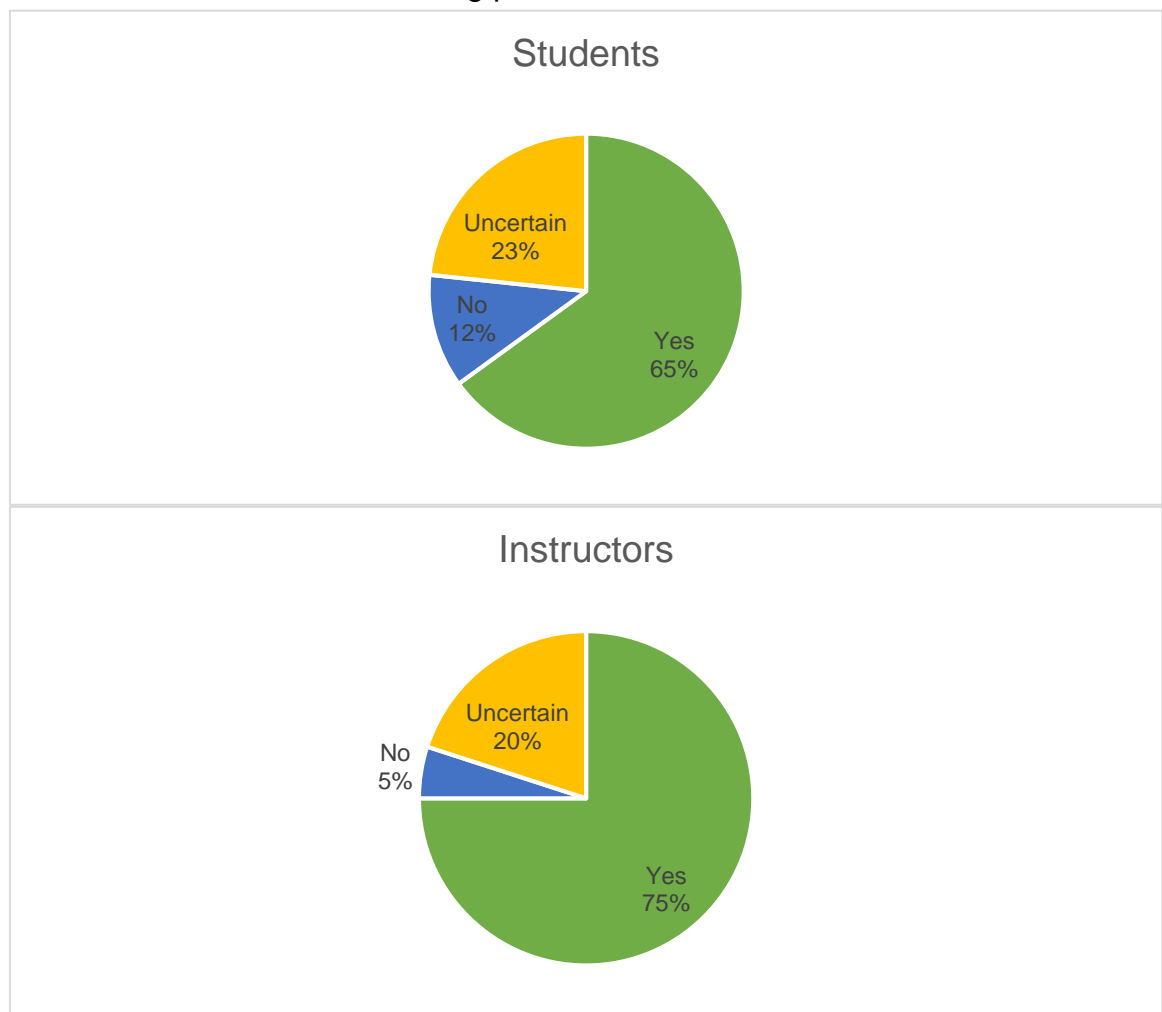


Figure 96: Will Mobile TEL assist in increasing the engagement of Students to eLearning?

judgment, yet a majority of 65% of them believes that mTEL will achieve its goal. Instructors seem to be more certain in total towards the achievement of mTEL's objective with a high 75% positive response. Thus, it may be considered that the participants agree that mTEL will achieve to maintain an updated community with respect to activities, changes and interactions that occur at the eLearning web-based application and any other mainstream technology used to facilitate learning.

Overall how would you rate the Mobile TEL application in terms of assisting in the increase of course interactivity between Students, Instructors and eLearning applications used by your organization.

Finally, in Figure 97, 82% of the students evaluate mTEL as good or excellent application in terms of assisting the increase of course interactivity between Students, Instructors and eLearning applications used by the higher education institution, while 80% of the instructors agrees with this evaluation. In effect the

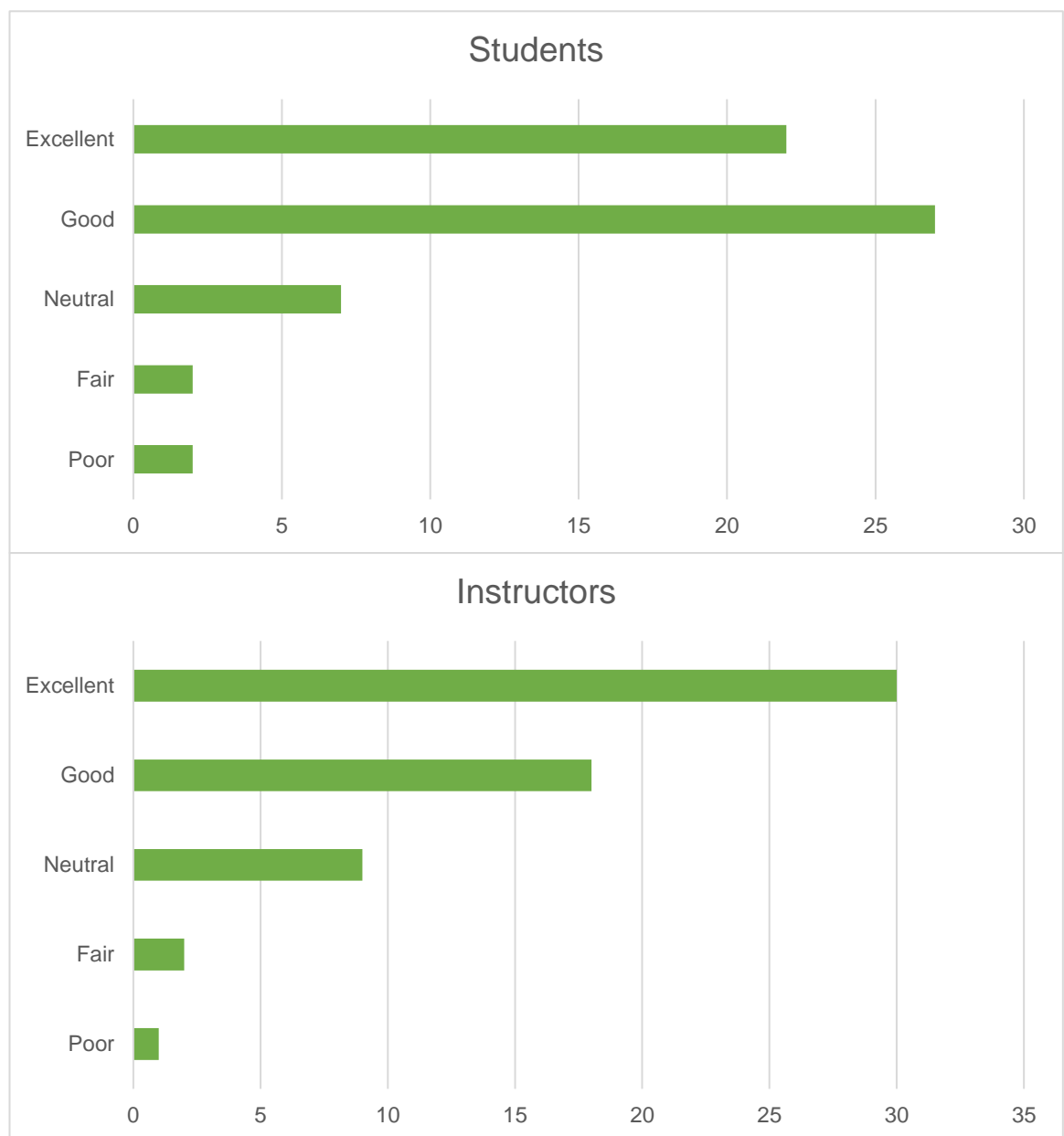


Figure 97: Does mTEL assist in the increase of course interactivity between Students, Instructors and eLearning applications used by your organization.

majority of the participants confirmed that mTEL achieves both up datedness of the members of the learning community and engagement to interactive actions required for constructive learning.

Considering all questions and responses of this survey, it become evident that students and instructors clearly believe that mTEL will succeed in all its objectives.

6.2.3 mTEL Survey Evaluation Qualitative Questions & Findings

In some of the quantitative questions presented and analyzed in section 6.2.2 mTEL Survey Evaluation Quantitative Questions & Findings there was an 'other' answer option which allowed the participant to state an alternative answer from the ones available by the question's response options. Only one such response was offered by one instructor in the question asking if the user interface of the mTEL app is considered to be user friendly. The response suggested that the mTEL user interface should not use calligraphic fonts as shown at the screenshots of the application at the presentation but also in section 5.4.6 Mobile TEL Theoretical Model Data Flows. However, the fonts are not determined normally by apps, but by the operating system and mTEL is no exception of that. The screenshots presented in this thesis are taken from a prototype application developed for the Android Mobile Operating System and used to exhibit the screens at the presentation which preceded the survey. The particular device used, was set to use those fonts. mTEL will adopt any fonts the users chose to use anytime in their mobile device.

Finally, an open-ended question at the end of both the students' and the instructors' survey encouraged participants to offer any comment or recommendation they thought could assist in the proper evaluation or further

enhancement of the application. Both groups of participants offered several comments and some valuable recommendations.

Students

Most student comments were positive and encouraging referring to mTEL. It was considered as an excellent, brilliant, great or very promising idea that they would choose to download when it becomes available.

CONCERNS

Developing a good voice command system would increase the overall production cost of the application.

That would be true but this is not an option of mTEL. An important objective of mTEL, is to mostly be a light and low energy consuming application and to decrease development costs. Therefore, mTEL uses whatever technology is available by default by the operating system of the device in which is installed. In our case, Google Voice Actions (*Voice Actions*, no date) are used (since the presented screens come from an android phablet), but could also be Siri (*iOS - Siri - Apple*, no date) if an Apple iOS device is used or Cortana (*What is Cortana?*, no date) in the case of a Windows based device. Consequently, the cost of development and the burden of the code is transferred to the native OS based vendor along with the cost of maintaining and updating the application. This confusion was probably caused by limitations of exhibiting the application through a PowerPoint presentation and not through hands-on practice. In any case it is not a weakness of the application, which optimally resolves the issue.

The application may largely assist committed students but it will not play a significant role, if any, to students not dedicated to learning.

This may also be true, although an argument could be that some of those indifferent students that otherwise would never or rarely get updated on changes or activities in the learning community unless they were forced to. Now because they receive these updates in a mobile device and because they are also delivered through popular apps they use like Facebook. They will ‘mandatorily’ be exposed to them. That may increase the possibility that they will find one notification interesting enough to trap them into a learning activity. Obviously, this is just an assumption, but it does have logical grounds. Nevertheless, these students are not considered the target audience of mTEL. mTEL is an application made to assist not only those who are mature enough to pursue learning, but also instructors who are committed to learning. It does not attempt or pursue to change people attitudes about learning or their character.

Will students require training?

It seems that only for a small sample of participants (only two students), consider mTEL as an application difficult to use. Obviously, for such small numbers no training is justified. These student’s perception of difficulty may have been caused by the lack of hands-on practice thus making it difficult to foresee the application’s potential and make an accurate evaluation. With respect to those students that found the application generally easy (apart from a very few confusing areas), training cannot be made available unless these areas are specifically depicted. Then, if such areas are still identified and are not just confusions caused by presentation inefficiencies, it will be determined if the problem is best resolved by redesigning the specific part of the interface or some short of training (e.g. help website, training video, etc.) is made available. In-class training is usually impossible for such large audiences, but some small sessions may be introduced

as part of laboratory sessions already offered for introductory IT modules which are open both to students and instructors.

Will sign-in be required every time mTEL interacts with a collaborating application?

As described in *Mobile TEL Setup* section Considerations once mTEL is in executed for the first time the user has to provide sing-in credentials for all the collaborating applications they want to use. Sign-in will be required once for each collaborating application. There after these credentials will be automatically used in every future interaction, as described by the registration process at the Data Flow Diagram in Figure 58, section 5.4.5. This causes no inconvenience to the user as compared to other applications and services sign-in process.

RECOMMENDATIONS

Link notifications referring to dates, like deadlines to the calendar application of the device.

This is considered a useful feature enhancement for a next version of mTEL. Calendar may be added to the list of applications that collaborate with mTEL, permitting users to directly set reminders and tasks based on date containing notifications.

Grouping of notifications per originating application and person.

Grouping is more convenient as a means of organizing information in applications that run in larger screen devices such as desktops and laptops. Mobile devices screens have size limitations to support that type of data organization which require scrolling left and right thus it not convenient and not recommended for mTEL. Alternatively, mTEL provides filtering of notifications tools so the user may

see only notifications from specific applications (e.g. Facebook) as described in section 5.4.6 Mobile TEL Theoretical Model Data Flows(Notification Subsystem). Unfortunately, such details are difficult to deliver through an automated presentation like the one used.

Could a search field be added at the notification screen so that users may perform keyword searching in notifications.

This is considered another useful application enhancement. However, there are advantages and disadvantages. Embedding a search engine in mTEL's code would not cost much or pose a difficulty since such open source scripts are widely available. However, such action would burden the application and would compromise one of its most popular characteristic of being a light and low resources consuming application. Furthermore, it achieves the prompt up datedness of its users, so normally, read notifications will eventually be accessed and cleared. Thus, for the majority of engaged and committed members, the notification list is expected to be a pretty straight forward feature that does not to require a search engine to locate a notification. Embedding such technology for the minority of indifferent or non-engaged students would not be a justifiable action. A good idea for a next version of mTEL would be adding the feature of using flags for notifications (like 'important' or 'follow up' symbols) to be used by the user as graphical future reminders instead of being dismissed when read.

Instructors

The few comments offered by instructors are referring to the following concerns.

CONCERNS

It always depends on the instructor, the course and the learning activity. Is this application appropriate for all learning activities?

That is true. mTEL is not built to substitute the instructor. mTEL is a tool that aims to assist both instructors increase the efficiency and the convenience of what they already do. Instructors are still the leaders of the class, and as leaders they are accountable on their actions. Unless, they design a useful course, develop and implement eLearning activities and initiate the required communication, mTEL cannot offer any service as all these actions are prerequisites of the services provided by mTEL. Should the instructor initiate eLearning activities, mTEL will significantly assist, both the instructor and the students, in increasing the up datedness of the eLearning activities, reduce response times, deliver the service everywhere due to mobility and potentially utilize more appropriate available devices.

With respect to the second part of the comment, mTEL is a theoretical prototype model and from that theoretical perspective, mTEL may be customized to fit any eLearning activity offered by already existing technologies, primarily by the institutional eLearning platform. Besides, mTEL's objective is to facilitate a prompt and more convenient access to eLearning activities which already run in their original environment (i.e. a web site or any mobile app). This is achieved in a more efficient and productive way. It is not attempting to execute activities by itself. That would make it an extremely heavy, limited and technically impossible to handle many activities because of hardware limitations (CPU & Memory).

In time, interest to use it will diminish.

This concern is something that should be seriously considered. The success and the sustainability of an application like mTEL is directly related to existing instructor leadership and student commitment which are the required foundation. mTEL offers a major contribution in eLearning technology by facilitating it through a service that will assist the efficiency and productivity of current implementations.

If this concern is addressed from a Project Management point of view, then the burn rate of Mobile TEL would be the time it will take for mTEL to go out of scope, or when mTEL's efficiencies are being lost (*Burn rate*, no date). Assuming that, since mTEL services rely and supplement existing implementations, it will decay following the life cycle of those implementations. However, this is acceptable, since the mobile offers enhancements to current technologies. Finally, if mTEL is put in actual production, its burn rate will obviously depend on the time it will take for a competitive more updated application to be produced. However, these are commercial and not scientific concerns and no matter how many versions of commercial or non-commercial similar applications may compete in the future, mTEL being the parent of all would be the actual proof of its success and contribution.

Perhaps there is the risk of an 'always on' situation - where students expect a reply at whatever time of day, following a pattern that they might use for (say) Facebook but which is not suitable for interaction with a tutor in a learning situation.

First, that would mean that mTEL is an extremely successful application. Furthermore, the instructor does not need to follow nor encourage such pattern. Students already use technology to communicate during hours that are not "appropriate" to expect response either from their instructor or anyone else. If

they send an email at night, the instructor is not responsible to provide an answer at that time. If students were engaged in Blackboard, there is nothing that would stop them from having a similar behavior. However, the problem addressed here is that students, but also instructors do not engage enough to receive the benefits of constructive eLearning activities. Finally, as the world changes, learning changes. eLearning is highly used for distance learning for obvious reasons. However, distance learning is not just offered for different students, but also in different time zones. That is may also produce an 'always on' situation. Being able to respond faster and more conveniently with mTEL may, in fact, help reduce the problem.

While the notification could be helpful, the user may still have to log into the application separately, thereby reducing the time saved by the app. For example, if the notification to a student says that an attempt has been graded in the LMS, the student will still have to login to the LMS to see the instructor's comments and grade on the assignment.

As explained in the Students' Concerns section above, mTEL requires a sign-in process once in its first time use and once every time a new collaborating application is connected similarly to other mobile applications.

6.3 Mobile TEL evaluation by eLearning Experts

Experts in the field of eLearning were invited to participate in an evaluation survey. Among them four accepted the invitation and Skype meetings were held to present and qualitatively discuss their insight with respect to the Mobile TEL application, provide their recommendations and evaluate the contribution of this novel proposal in science.

eLearning Experts profiles, key points and the outcomes of these sessions will be discussed per participant in the following sections. Summarized transcripts may be found in Appendix VII.

6.3.1 Experts' Positive Observations³²

Overall experts gave a positive evaluation to the presented features of mTEL giving an overall rate for the application between four and five.

While there were many details explored during the interviews based on the flow of the conversation, the following key areas were brought to the discussion with all experts:

Provide an overall rate for mTEL on a scale of 1 to 5 with 1 being 'very poor' and 5 being 'excellent' based on the presentation and discussions made. Please make an overall evaluative comment for the presented model.

Dr. Lucas rated the model with 4.5.

Dr. Lucas observed that overall “*mTEL will bring value to students' learning ... because of the way it is connecting apps and services*”. She thought that mTEL is “*a great idea that she would like to see being developed*”. She also added that mTEL “*will contribute to*” increasing the engagement of both students and instructors with current eLearning web-based platforms.

Dr. Rohlíková rated the model with 4.

Dr. Rohlíková's overall evaluation comment was that mTEL is a “*unique and interesting*” idea especially in the way it handles notifications.

Professor Miltiadis D. Lytras rated the model with 4.5

³² Interview transcript summaries are available at Appendix VII for all expert evaluators.

Professor Miltiadis D. Lytras observed that the Mobile TEL application *“is really interesting”*. *“It combines and brings many fresh ideas in the eLearning arena”*. He said that mTEL *“offers added value to the instructor”* by enabling them to use the application simultaneously with other services. Based on his opinion, Professor Lytras suggested that mTEL’s main contribution will be the increase of instructors’ engagement, who, in his judgement, are not so engaged to eLearning implementations. He commended that mTEL is *“a very good system that depends on state-of-the-art technologies and includes really interesting theoretical parts that its users will easily realize and adopt”*. He also commented that modern students will *“love”* an application like this, since it will keep them updated and thus engage them to the eLearning content or activity without for example having to login to the LMS. Students *“get information on-time without having to access Blackboard, ... and it’s a good proof of concept that things similar to Facebook can make eLearning activities more interesting”*. He argued that mTEL, contributes also in the sense of providing a good response to *“monolithic”* (proprietary/closed) platforms, thus *“introducing new ideas in eLearning by bringing social media in the game”*. Professor Lytras also added that *“the fact that the application has integrated services from different vendors and acts as a good plugin for Facebook and other famous social networks is a good standing point”*. Additionally, Professor Lytras said that the idea presented stands on *“a good base, so its contribution will be really amazing!”* Finally, Professor Lytras concluded by saying *“I was happily surprised because the prototype built, requires a lot of effort that will deliver an excellent research for the thesis and I foresee that such systems are useful for the knowledge society and for sure, if there is some support, this technology can be commercialized”*.

Professor Bleimann rated the model with 4.5.

The flexibility of mTEL to adjust to user preferences with respect to collaborating apps was highly appreciated by Professor Bleimann. Professor Bleimann in his own words, found the mTEL “*a good idea ... so convincing and so clear that it is strange that nothing like this already exists*”. He suggested that investors may be very interested in the development of a working mTEL model since through it, a clear advantage will be offered in learning.

mTEL’s up-datedness logic supported by the mTEL notification system for updates originating from the various already installed applications (with emphasis to social networks and messenger services) at the users’ mobile device will lead to more prompt interactions with current eLearning implementations. Will this logic assist in the increase of the engagement of users to eLearning?

They all agreed with the up-datedness benefits of the multidimensional notification system involving user apps, social networks and mobile services. They all positively supported that this feature may increase attendance and interaction with eLearning implementations assisting in the fulfilment of the educational objectives.

Dr. Lucas specifically mentioned that the notification system uses a familiar logic with the one that social media use. That way, she argued, similarly, for example, to “*receiving notifications from friends regarding a party, a movie or a concert, I would also like to receive something that connects me to my courses, so I think it’s a great idea*”. She also agreed that mTEL will “*certainly*” reduce the time for eLearning users required to be updated, leading to increasing the engagement of its users to eLearning content and activities.

Dr. Rohlíková, also thinks that mTEL *“is a great and useful idea”* provided that the user is *“able to choose”* which applications will be sending the notifications, an option that is already provisioned by the model’s design. She also agreed that up-datedness will increase the engagement of users to eLearning activities.

Professor Lytras said that the presented up-datedness logic will bring *“very good engagement”* results. He added that the *“current gallery of tools and the combined applications provide a good starting point for personalization. So, access through a personalized system will add to the engagement of users with eLearning”*. He also added that *“mTEL is really good because students should be able to investigate multiple services”* which is achieved with mTEL’s integration with social media, messengers and other technologies.

Professor Bleimann commented that *“it is a great advantage that you don’t have to reinvent the wheel by using what exists already”* referring to the utilization of already installed applications at the user’s device. Additionally, he thinks that the notification system logic will *“increase the engagement”* of its users to eLearning implementations.

mTEL, based on the origin of the notification, it invokes the corresponding service of that application to interact with the notification activity. Consequently, such services were not included in the architecture of mTEL reducing its storage size and memory requirements and transferring upgrade requirements to the application whose service is invoked.

Experts agreed on the usefulness of implementing a technology that invokes the appropriate installed application to interact with an activity as a means of simplifying the response process. This eventually will reduce the required time and required expertise and consequently will enable more users to participate

leading to the core goals of mTEL. Additionally, experts found this feature to be architecturally and cost efficient. It leads to a light, low consuming application, since no code was built for services provided by third parties. In addition, it offers the side-benefit, that there is no need to develop or maintain third party technologies otherwise required for interacting with eLearning activities.

Dr. Lucas agreed that this architecture *“does not consume memory, does not occupy storage space and will not affect the operation of other applications I use in my smartphone”*.

Dr. Rohlíková characterized this feature as *“Perfect”*.

Professor Bleimann said that the fact that functions used by mTEL are based on technologies of third-party applications which are updated by them, would be *“a benefit especially for a startup company that would want to develop the application, because you don’t have to invest for building those technologies and their updates”*.

The server-side application is responsible for retrieving notifications from cooperating applications and services. If new notifications are found they are pushed to the mTEL’s users thus limiting traffic only to notification updates.

Please state your opinion about this feature.

Experts agreed that the push notification system is increasing the design efficiency of the model in terms of reducing its connectivity activities to the minimum required. mTEL is designed to only receive data when new updates appear by transferring the burden of querying cooperating services to the server side application. This, not only impacts to the energy consumption of the device

but also to the use of the available connections especially where charges are applicable. All experts have evaluated positively this architectural logic.

More specifically, Dr. Lucas found this logic important for Spanish students who avoid mobile connections due to charges. Because of this logic, such charges are mostly insignificant, while the otherwise not-informed student may now be motivated to find Wi-Fi coverage to address the notification earlier.

According to Professor Bleimann, based on his extensive experience in software engineering, identified that “*push is the right technology to use and that it makes sense to his eyes*”.

mTEL offers the ability to transmit content in the most appropriate format so that it is made available in a larger number of available, possibly more appropriate, devices. Please state your opinion on this option.

This feature was also found to be a very useful feature by all evaluators. Experts seem to agree that the more options available leading to learning activities the better are the chances to reach a larger audience, thus increasing the possibility for more active and engaged learners.

Dr. Rohlíková found this feature to be “*very nice*” because of the ability to adjust content based on a variety of target devices.

By invoking the devices voice command system mTEL may offer additional access to eLearning for visually challenged people and moreover enable its users to respond while having their hands occupied with other tasks. Please state your opinion about this feature.

Moreover, it was agreed that the use of the native voice command system, besides providing a convenient option for visually challenged people, it acts as

an alternative way to interact with mTEL and through it with online learning activities. This releases the hands of the users from the keyboard or touch screen, thus possibly enabling them to use mTEL in parallel with other activities. This benefit addresses the time constraint that was stressed by instructors and identified by evaluators and provides for an opportunity to increase promptness in responding to eLearning applications. Thus, evaluators expressed that the use of the native voice command system may offer benefits to the overall design of the model.

Particularly, Dr. Lucas found the notification integration to be a “great idea” while Dr. Rohlíková also thinks that this option will “*help*” carrying tasks simultaneously and especially for “*people with sight problems*”.

Did you think that the screenshots represented mTEL’s functionality appropriately? Based on these screenshots, what is your opinion with respect to the clarity and navigation of the application with respect to its GUI?

Finally, based on the GUI made available through the presentation, it was expressed, that mTEL seems to be a straight forward application with similar navigation and interface logic to the commonly used social apps, Additionally, since a large part of its use invokes cooperating apps functions with which users are familiar (i.e. native cooperating app editors to respond, etc.), there is nothing that seems to be causing a challenge in terms of usability.

Dr. Lytras, based on the presentation screenshots, commented that he “*appreciates the fact that mTEL is user friendly*” which is assisted by the fact that mTEL has “*adopted applications which are already familiar to users*”.

6.3.2 Evaluators' Concerns/Recommendations

One relatively simple recommendation was that a mute button is added at the configuration screen of mTEL, to provide the user with the option to mute notifications coming from a certain application, thus increasing their control over notification management. Another similar recommendation was to add some extra functionality with respect not only to originating apps but also to specific people. The idea here refers to something like 'Favorite people' being stressed with a flag, to distinct them from others. Such, minor improvements are quite easy and may be added to a next version of mTEL.

Specifically, Dr. Lucas and Professor Bleimann expressed the concern that an application like Mobile TEL may create an information overload with all these generated notifications due to the increase of interactivity with the connected cooperating apps, mainly used by the eLearning platform. The main argument here is that if information overload occurs because of mTEL. First, this would mean, that mTEL has succeeded in at least increasing interaction thus providing a higher chance for more engaged users with the eLearning platform. Thus, aside of the information overflow challenge, mTEL's main objective was achieved. Mobile applications like Facebook, also have the side effect of information overload, because many users are actively interacting with the application. This is a confirmation that the application has successfully achieved to engage a large number of users in the service offered. So, information overload would be the strongest evidence of mTEL's success. Nevertheless, information overload will in fact be a challenging side effect of the success of mTEL that may affect the sustainability of the application despite its benefits. After a period, users being bombarded with a variety of notifications (some of which may be redundant), they may lose control of the eLearning activity or fill overwhelmed by the large number

of notifications. Such users may start dropping-out from the activity or even decide to stop using the application. This phenomenon is familiar in corporate eLearning implementations whose users may be considered more mature but also more motivated, since completion of such activities is directly related to their job requirements (Succi and Cantoni, 2008).

To cope with this challenge, several options have already been included in this prototype design and some additional may be added in future releases, as indicated by survey participants and expert recommendations. Firstly, the user is given the choice on which installed applications to connect to mTEL, thus having the option to limit the traffic of notifications to fewer sources. For example, if an mTEL user mostly uses Facebook, he may not have a reason to connect mTEL with every other notification generating app, installed in his device but not actively used. This will limit notifications only to Facebook. Furthermore, the user is already provided with filtering tools that they can browse a shorter list of notifications, when a plethora of such messages populates the notification list of mTEL. Following the recommendation of another expert evaluator (Dr. Rohlíková), this list may also be narrowed down by implementing a Favorite Contacts filter, that would further narrow the list of notifications, to those coming from specified people. Finally, an additional option could be, to add some software that will be responsible to compare notifications and locate those that although having the same content, were generated by different connected applications. Once such notifications are found, they might be grouped under one notification, narrowing down the total number of the notifications received. By selecting such a notification, it would expand, showing a list of the originally received applications so users may choose the one they prefer to interact with,

based on the application that originated it. Considering these observations, Dr. Lucas and Professor Bleimann agreed that information overload is a positive situation indicating success of the apps objectives, while solutions already exist and can be furtherly expanded to effectively limit or even eliminate the problem.

Another argument was, that in some cases the invoked application environment might not be suitable for some eLearning activities. In a next version of mTEL, a problem workaround for this limitation would be for mTEL to have a content scan mechanism and based on provided keywords, tags or metadata to invoke the appropriate application and not the one that pushed the notification where applicable. Another simpler approach could be for mTEL, to offer a list of suitable available mobile apps, so the user can select the one considered most appropriate. The user's choice could optionally be stored to permanently access such content using the initially selected application as a default, thus to avoid thereafter, questioning the user in every such occasion.

Another concern was that invoking the already installed by the device Voice Command system and other native services may be a challenge due to the different architectures implemented by the different vendors such as Apple and Google. It is true, that in order to cover most of the market, due to different OS platforms and technologies, requires multiple versions of the application suitable for each market platform. This is a common cost factor for all successful mobile applications. A possible design strategy, if the development cost for different versions is considered too high to be covered by an initial investment, would be a phased introduction (Baltzan, 2015) of the Voice Command feature per platform. For example, a full version of mTEL that includes the Voice Command System may be initially released for Androids, which cover the largest part of the

users, (Android market share is first with 82.8% coverage second by iOS with 13.9%) (IDC: Smartphone OS Market Share 2015, 2014, 2013, and 2012, 2015) and later on for the IOs and remaining platforms. This achieves stretching the development costs over time which is a way to deal with shortage of initially available budget.

Professor Lytras observed that mTEL may serve as a “very good basis for running experiments and collecting eLearning user’s data” something that was not included among the objectives of the application. Based on this recommendation by implementing some minor additions, mTEL software can transmit on-line usage data to the application server. This data can be used for research purposes thus providing an additional advantage for researchers in the learning community. He also observed that although some features of mTEL at first glance look interesting and exciting, they do not seem to be economically and technically feasible (Whitten, Bentley and Dittman, 2001). This would be the case, at least for institutional installations not based on Open Source LMSs like Moodle, as they may require changes on the side of the institutional platform. Nevertheless, in the future, the technological evolution may provide for such shortages required for such an idea to flourish. Towards this path, Blackboard has made changes in its platform architecture to permit adaptation of third party applications such as web eBook access points and Turnitin (Turnitin UK Blackboard 9.0 Integration Instructor User Manual. 2.1.3, 2011) through the development and implementation of “Building Blocks”³³.

³³ Building Blocks refers to small third party applications developed to cooperate with Blackboard in providing additional functionality, for example turnitin assessments in addition to Blackboard assessments.

6.4 Conclusion

The evaluation process was based on quantitative surveys for students and instructors and qualitative discussions with eLearning experts. The purpose was to record the intentional behavior of appropriate groups of participants with respect to the potential of mTEL's ability to add value to current web-based LMS and contribute to learning. The designed Mobile TEL prototype has been viewed as a novel and innovative technology that is being introduced in the eLearning ecosystem. The evaluation indicated that mTEL has a high probability to achieve increasing and preserving the population of eLearning users thus increasing the effectiveness of current eLearning implementations including the more complex constructivist ones. At the same time, mTEL prototype manages to remain a low-cost application in terms of maintenance and upgradability and a low resource demanding application thus eliminating weaknesses that may encourage users to disengage. Finally, most of the concerns expressed, referred to minor limitations of the model while for all of them solutions are available that may decrease or eliminate their effect.

7. Conclusions & Future Work

This chapter is divided into three sections: Research Achievements, Research Limitations and Future Research.

7.1 Research Achievements and Conclusions

The mTEL application design has been the outcome of a long and wide research made to understand the learning ecosystem and the multidimensional requirements of learning arising from students, instructors and administrators. Pedagogy, technology at large and eLearning services were examined to find an opportunity for providing a novel contribution with an actual practical implementation potential. Current non-learning technological ecosystems, which intersect with learning by attracting users including learners to their services, were studied. The objective was to identify possibilities and take advantage of their benefits in order to serve the aims of learning. Understanding the current online technological framework, assisted into perceiving the two dominating principles based upon which Mobile TEL was designed. The primary objective was, instead of bringing learners to eLearning, bring eLearning to learners everywhere. This is achieved by offering a ubiquitous way to promptly access, receive and interact with eLearning content and activities of current eLearning implementations. This is achieved while time and location restrictions are reduced, utilizing the availability of the Internet and other technologies, thus also reducing the mobile device limitations. mTEL is an independent system that allows the user to view learning related information in a variety of different forms and devices. At the same time, it keeps the user alert of the availability of such information and enables him to interact with it, where applicable, via a variety of ways. Considering all, it can be acknowledged that mTEL may have a positive impact in the engagement of learners with eLearning implementations. The

second objective achieved, was to design a mobile application that would take advantage and utilize existing technologies which leads to a low consumption software with reduced development and upgrade costs.

Additionally, the combined research of pedagogy and related technologies helped understanding that there are very minor challenges in modern eLearning platforms with respect to their alignment to a variety of learning theories. Despite this fact, both students and instructors do not engage to the level expected and required for eLearning implementations to effectively take advantage of their full benefits. Thus, the research at this point, helped shifting the focus of the thesis from possible enhancements of learning theory implementations to focusing into identifying and developing a technology that would assist in bridging the gap between learners and eLearning. Thus, pedagogy and eLearning research contributed deductively in this thesis. They identified an area in the modern learning ecosystem that although not directly related to learning content or activities, it revealed a gap that seems to be an important reason for the low engagement levels of users to LMS. Based on these findings the mTEL theoretical model was perceived and designed.

Based on the outcome of the evaluation of the model by students, instructors and eLearning experts, mTEL is a proposal that is clearly perceived by its potential users (based on the evaluation outcomes) to increase awareness of eLearning users with respect to eLearning activities' updates using mobile applications most popular to users for personal reasons. So, since literature review and surveys prove that learners favor most and spend a significant amount of their time on social media and messengers, mTEL brings eLearning notifications and the ability to interact with them using the most preferred by user's apps. This service

is provided by taking advantage of all possible technologies that might be available to users (i.e. TVs, projectors, Car-Kits, mobile sensors and systems, etc.). That way mTEL achieves making available mTEL services while limiting time, place or device restrictions, thus enhancing and simplifying the promptness of eLearning interactivity. Evaluators of mTEL agreed that user awareness is a key factor in increasing the engagement of users to eLearning activities. Furthermore, besides achieving the learning related goals of the application, it is necessary to consider that a key element to success for any application is the cost of maintenance and usability in technical terms. mTEL, utilizing existing technologies for several core functions, transfers most of the maintenance and upgrading cost to those technologies hence becoming a very low maintenance application. At the same time, mTEL was designed in such way so that it mostly acts as a light aggregator of information that utilizes collaborating apps and other existing technologies for processing eLearning requests. Consequently, mTEL does not burden the user's device, nor consumes their network bandwidth or incur mobile telecommunications charges. All these would-be reasons for dissatisfying users enough, to uninstall the application, even if they have recognized its benefits. Finally, mTEL is a simple idea and simplicity is well known to be a major benefit in application development. It directly leads to development time and cost reduction.

Overall, mTEL offers an innovative, very simple, fast to respond, easy to use, low cost approach to utilize and enable all modern popular technologies offered to learners, around and about learning, positively affecting the increase of the engagement of its users to learning.

Concluding, Mobile TEL contributes a novel, innovative and feasible technology that offers solution to most of the weaknesses of current learning technologies - whether blended or not - with social media and other popular non-learning on-line services. At the same time, it succeeds in combining the benefit of modern popular services and mobile technologies introducing a ubiquitous eLearning experience of a virtual learning community that is free of time, location barriers and limitations of specific technologies.

7.2 Research Limitations

Some limitations need to be considered for this research:

- The first two surveys to instructors and students, although invited participants from both UK and Greek Higher Education institutions, were mostly answered by undergraduate participants of a private Higher Education institution in Greece limiting the possible variety of collected data. Nevertheless, the samples were chosen from a multinational, multicultural population from a variety of disciplines and levels to reduce this problem. Finally, there was no evidence to suggest that the findings of the survey are not more generalizable as many of the results reaffirm prior research findings.
- The first two surveys to instructors and students were based on web-based questionnaires mainly due to time constraints. Therefore, the benefits of processing open-ended questions or other more qualitative tools was not utilized. This limitation was compensated by holding frequent informal discussions with both students and instructors helping to understand user perceptions, experiences and behaviors at a more knowledgeable level than just relying on questionnaires.

- A complete working prototype was not developed. The prototype that was developed was mainly used to provide screenshots of representative screens of mTEL in order to assist presenting mTEL to evaluators but also help reading this research. A complete working prototype that could simulate use-case examples of mTEL would assist in retrieving more accurate evaluation results with less intervention by the presenter. However, due to time and budget constraints it was not possible to develop one. However, at this stage, the purpose was to record the behavioral intent of various users based on the evaluation of the operating principles and goals of the related model and not to evaluate a piece of software. Evaluators were mostly called to assess the potential of a concept for developing an application rather than the usability of such application, although that was also addressed by the surveys. The smooth operation of the surveys and interviews along with the clarifications requested suggest, that overall, the selected available method of presentation has succeeded to present the concept under evaluation with clarity and completeness. Thus, the selected available method of presenting the model, although not the optimum, seems to have succeeded serving its purpose.
- The research is limited to a relatively small number of expert evaluators. However, due to the positive similar evaluation results by all involved participants, and the simplicity and benefits of the Mobile TEL concept but also due to the very high expertise level of participants this limitation may be considered as acceptable for the nature of this research. Additionally, the mTEL model was presented at the 10th annual International Conference of Education, Research and Innovation (Triantafyllidis *et al.*,

2016) were it also received excellent comments by peer educators while very few clarifications were required. Time constraints related to deadlines in this research and unavailability of willing participants, were primary barriers to the recruitment.

- The Mobile TEL proposal is limited by the availability of described technologies by vendors of collaborating apps. Although all the technologies addressed by this already exist and are operationally feasible, not all of them are made available or fully available by collaborating apps. So, the development of mTEL is limited to the availability of the addressed technologies by the collaborating applications. If an individual does not use social networking or associated applications, this approach would provide minimal benefit.

Considering all, the above limitations were carefully considered and measured as not to be causing any risk to the validity of this research plus the contribution and all the benefits of this newly proposed promising technology.

7.3 Future Research

Although expanding the survey and evaluation would have potentially offered a more in-depth insight into the limitations and opportunities of the eLearning ecosystem the benefit of developing and deploying an actual working prototype would be of importance. In the case that a working prototype that fully simulates the functionality of mTEL is developed, there would be an opportunity to embed usability tracking software in the prototype application that would enable researchers to study the use of the applications and potentially data collected by its interactivity with collaborating apps in a controlled group of people. Access to such data would not only assist in perfecting mTEL but also may provide an

additional valuable insight with respect to eLearning, mobile usage and learner behaviors enabling new areas of research that could be incorporated into new versions of the prototype.

Since mTEL is limited by the availability of required technologies by collaborating applications, an area of research opens in producing a standardized framework that needs to be considered by popular service providers in order to open the opportunity for specifically collaborating with applications like mTEL. Such technologies are already available but are mostly specialized in integrating and disseminating information relative to commercial and market activities due to their obvious high commercial value. Hopefully, this research and the proposed study may assist in recognizing an additional value in learning and attract the investments required to proceed to changes towards possibly a more noble than just business like learning were also very significant commercial opportunities exist.

This research may additionally be used as a reference to the identified weaknesses of the administrative and technological implementations in Higher Education. From this study, it is evident that further opportunities for research exist in order to produce best practices in the following areas directly or indirectly related to eLearning:

- Understand the limitations of eLearning in relationship with their cost/benefit factors especially for the long run and evaluate options in redesigning related financial budgets, course scheduling policies and eLearning implementation support thus optimizing learning drivers across the organization.

- Research and understand the pedagogical and technical knowledge requirements necessary for constructive eLearning developers. Based on these findings, define standards and design training sessions that would provide the appropriate expertise required.

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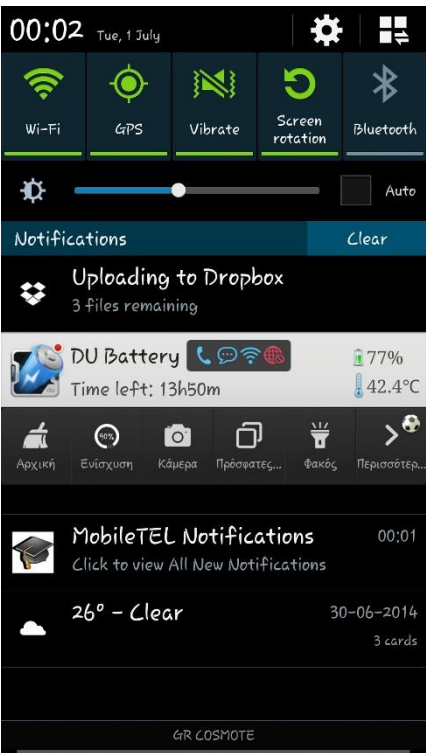
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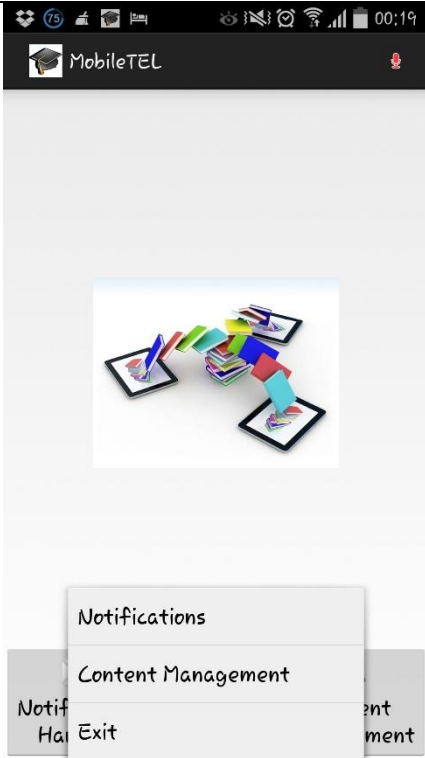
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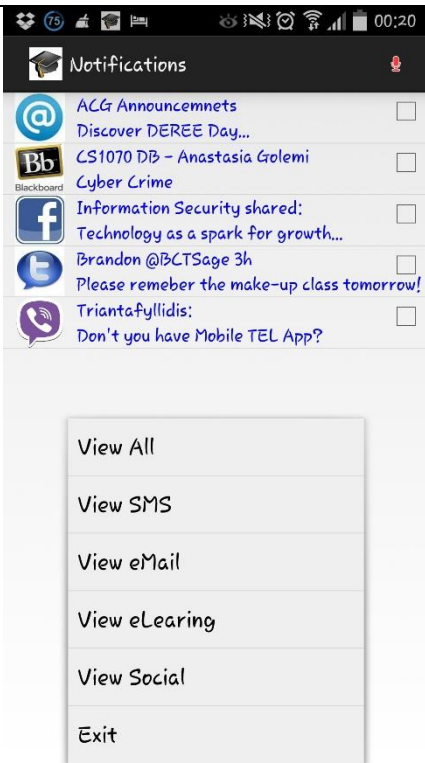
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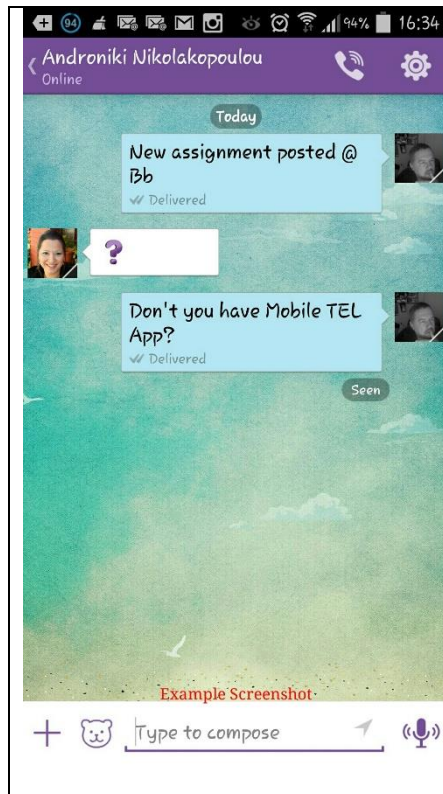
Appendix I - mTEL Prototype Screenshots

	<p>mTEL notification icon as it appears at the Android Notification Bar.</p>
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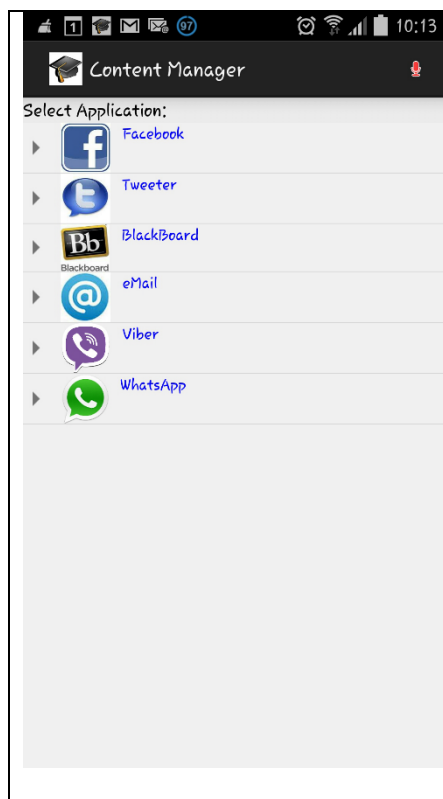
	<p>mTEL notification as it appears at the Android Notification System.</p>
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	<p>mTEL home screen with Android menu enabled and voice command system disabled (red mic indicator).</p>
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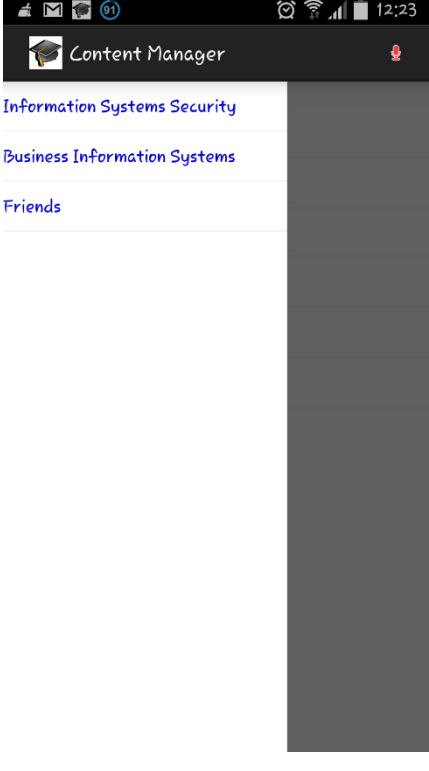
	<p>mTEL notification screen and native notification screen with Android menu enabled and voice command system disabled (red mic indicator).</p>
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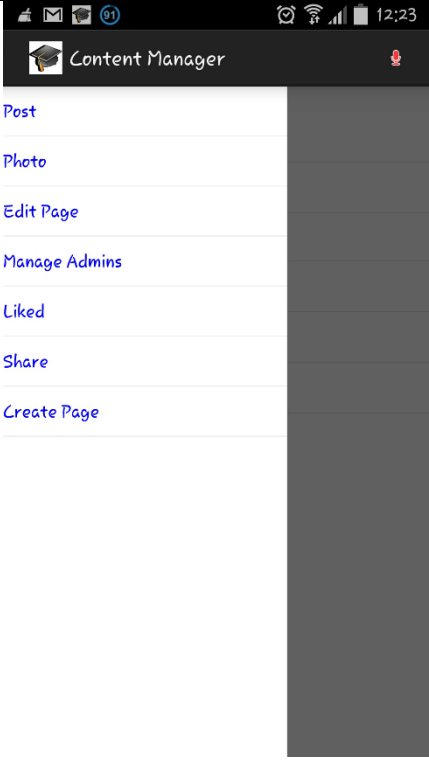


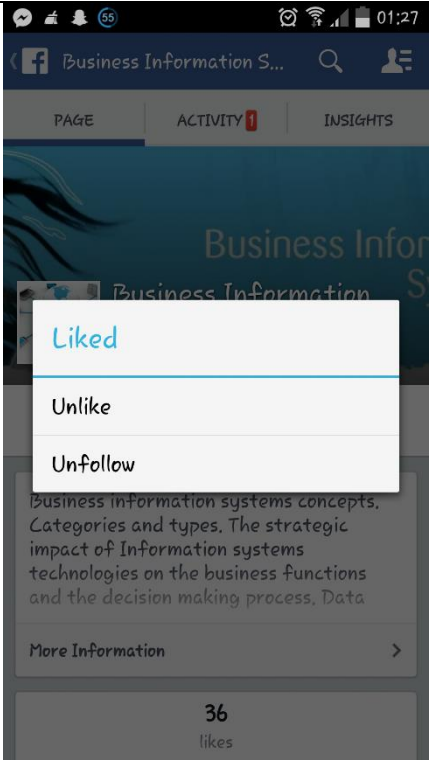
Viber messenger native application opens in reply mode of an mTEL notification originating from Viber.

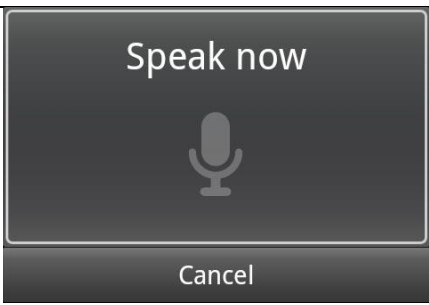


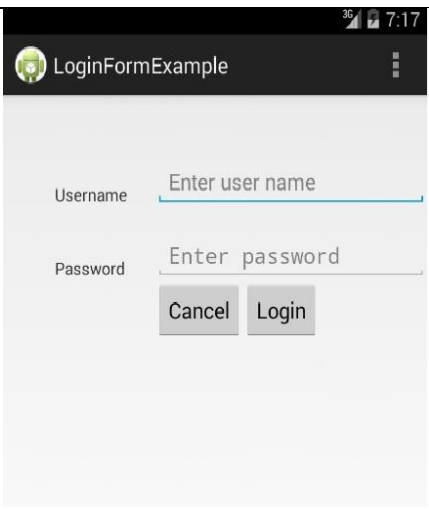
Content manager options screen opens when the content manager button is tapped at the mTEL home screen. Options are available for all configured cooperating installed applications. Each option leads to the corresponding cooperating application options where applicable.

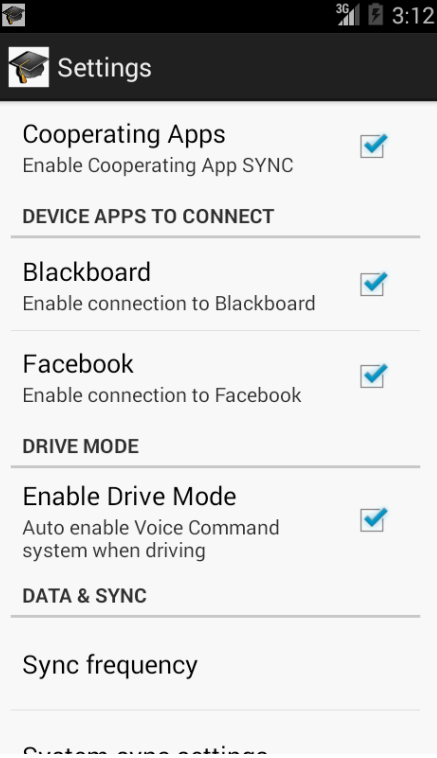
 <p>The screenshot shows a mobile application interface titled 'Content Manager'. At the top, there is a status bar with icons for signal, Wi-Fi, and battery, along with the time 12:23. Below the title bar, a list of course-related pages is displayed: 'Information Systems Security', 'Business Information Systems', and 'Friends'. The list is scrollable, and the background is dark grey.</p>	<p>Screenshot of mTEL Facebook available course related Pages through content management menu.</p>
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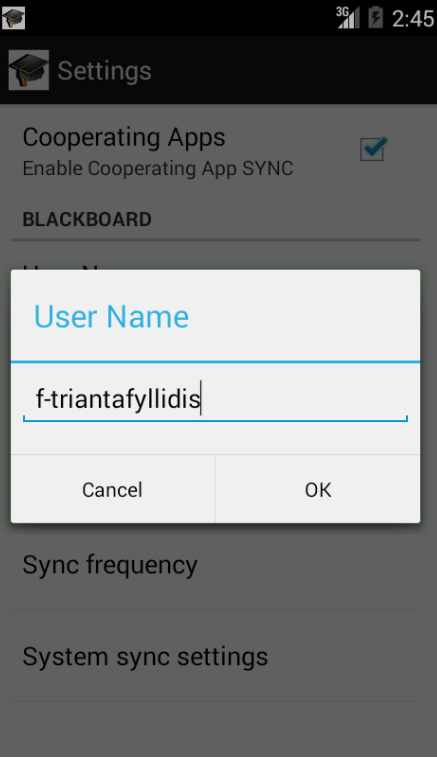
 <p>The screenshot shows the same 'Content Manager' interface. The list of options is expanded, showing: 'Post', 'Photo', 'Edit Page', 'Manage Admins', 'Liked', 'Share', and 'Create Page'. The background remains dark grey.</p>	<p>Screenshot of mTEL Facebook indicative available options once a course related page was selected at the previous screen.</p>
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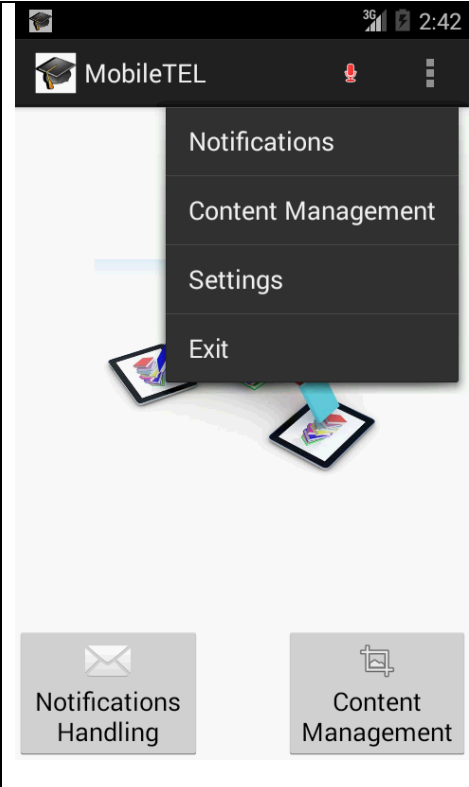
 A screenshot of a Facebook mobile app interface. At the top, there's a navigation bar with 'PAGE', 'ACTIVITY', and 'INSIGHTS'. Below it, a post titled 'Business Information S...' is visible. A white dialog box is overlaid on the post, showing 'Liked' in blue, with 'Unlike' and 'Unfollow' options below it. The post content mentions 'Business Information systems concepts, Categories and types. The strategic impact of Information systems technologies on the business functions and the decision making process, Data'. At the bottom of the post, it says '36 likes'.	<p>Facebook mobile app corresponding screen is invoked upon tapping the corresponding option in mTEL.</p>
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 A screenshot of a 'Speak now' voice command interface. It features a large microphone icon in the center. Below the icon is a 'Cancel' button. The background is dark gray.	<p>Notification upon enabling the Voice Command System</p>
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 A screenshot of the mTEL user login form. The title bar says 'LoginFormExample'. There are two input fields: 'Username' with the placeholder 'Enter user name' and 'Password' with the placeholder 'Enter password'. Below the fields are two buttons: 'Cancel' and 'Login'.	<p>mTEL user login form screenshot.</p>
--	---

 <p>The screenshot shows the mTEL Settings application. At the top, there's a status bar with 3G signal, battery, and time 3:12. Below is a header with a graduation cap icon and the word 'Settings'. The main content is divided into sections: 'Cooperating Apps' with a checked checkbox for 'Enable Cooperating App SYNC'; 'DEVICE APPS TO CONNECT' with 'Blackboard' and 'Facebook' both having checked checkboxes for enabling connections; 'DRIVE MODE' with 'Enable Drive Mode' having a checked checkbox for 'Auto enable Voice Command system when driving'; and 'DATA & SYNC' with 'Sync frequency' and 'Custom sync settings' options.</p>	<p>mTEL Settings Screen.</p>
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 <p>The screenshot shows the mTEL configuration screen with a modal dialog box open. The dialog has a title 'User Name' and a text input field containing 'f-triantafyllidis'. Below the input field are 'Cancel' and 'OK' buttons. The background settings screen is dimmed, showing the same sections as the previous screenshot, but with the 'Cooperating Apps' section expanded to show 'Enable Cooperating App SYNC' checked.</p>	<p>mTEL configuration screen. The users configure the cooperating mobile apps installed at their device based on their preferences.</p>
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 The screenshot shows a mobile application interface. At the top, there's a status bar with '3G' signal, battery, and time '2:42'. Below it is a header bar with a graduation cap icon, the text 'MobileTEL', a red microphone icon, and a three-dot menu icon. A dark grey screen menu is open, listing 'Notifications', 'Content Management', 'Settings', and 'Exit'. Below the menu, there are two large grey buttons: 'Notifications Handling' with an envelope icon and 'Content Management' with a document icon. In the background, there are faint images of tablets.	<p>mTEL home screen with screen menu enabled. The Settings option is made available here.</p>
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Appendix II – mTEL Presentations

Student/Faculty/Experts Presentation Slide



For best experience...
Please switch **on** your **speakers** and adjust your volume to a higher level.

To repeat the narration please press the **speaker**  button on the **top right side** of the slide where available. Hover on the speaker button for more options.



Click anywhere or press space for next slide



Welcome to Mobile TEL

A questionnaire will follow this presentation for you to evaluate the application.

Click anywhere or press space for next slide

Current Web-Based e-Learning offers...



Positivistic Content

- On-line announcements
- On-line course related information
 - Course policies
 - Textbook & Reading materials
 - Course Outline
 - Etc.
- On-line course related material
 - Lecture presentations
 - Links
 - Videos
 - Etc.

Constructive Activities

- On-line course related activities
 - Assessments with feedback
 - Forums or Discussion Boards
 - Wikis – Interactive Videos
 - Virtual Classrooms – Webinars
 - Etc.

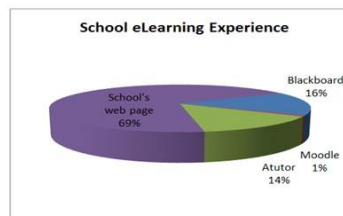
Constructive activities enable interactive engagement of students using eLearning platforms thus achieving deeper understanding of learning outcomes.

Click anywhere or press space for next slide

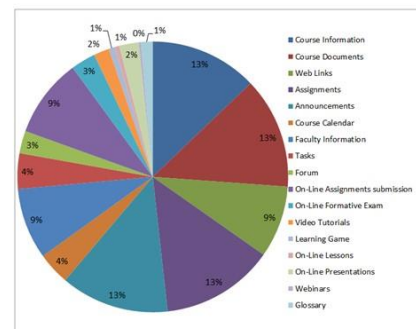
However...



Only 31% of the total population of students have experienced an LMS system



Constructive e-Learning activities are rarely accessed by students



Reference: A. Triantafyllidis, N. Clarke, P. Dowland (2012) LEARNING MANAGEMENT SYSTEMS IN HIGHER EDUCATION: A STUDENT PERSPECTIVE, *ICERI2012 Proceedings*, pp. 4046-4055.

Click anywhere or press space for next slide

Why web-based e-learning objectives are not reached?



- eLearning web sites are **not** among the top daily on-line habits of students and instructors
- Students are **not updated promptly** or at all of new e-learning activities
- Students may **not** have **access** to an appropriate or convenient device or network speed for certain learning activities or content (i.e. a pc might not be available for attending a HD webinar or a virtual classroom)
- eLearning platforms offer **limited mobile app versions** where complex activities or their features are not supported.
- e-Learning web sites are **difficult to navigate** and interact with
- e-Learning web sites are **difficult for visually impaired** people
- Instructors don't have the time to respond promptly to eLearning interactions. As a result student motivation to interact becomes lower.
- Other

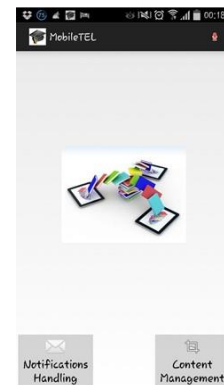


Click anywhere or press space for next slide

Mobile TEL Objectives



- To offer eLearning updated **awareness** at any time at any place.
- To **minimize the time** it takes to respond to any eLearning or course related activity.
- To effectively **utilize multiple channels of communication** including social networks, messenger applications, SMS, etc.
- To **increase interactivity** of both students and instructors with eLearning activities.
- To **assist** visually impaired people but also achieve parallel use of the app with other tasks by enabling a voice-to-text system



Click anywhere or press space for next slide

Never miss updates again



Mobile TEL ensures that the learning community (students and instructors) will **always be updated** on changes in eLearning content and activities:

- **Ubiquity** – Receive Notifications about updates **everywhere** through your mobile device (smartphone, tablet)
- **Integration** – Mobile TEL **aggregates and pushes content** from your College eLearning site through a variety of popular services like Facebook, Twitter, Blackboard, Viber, WhatsApp, eMail, SMS, etc. That way, no matter what channel is used for communication, you will get it all, once you use your mobile device.



Click anywhere or press space for next slide

Work Together



By keeping class members updated on eLearning activities and content, Mobile TEL increases the **interactivity** and **collaboration** of class members even when not in class!

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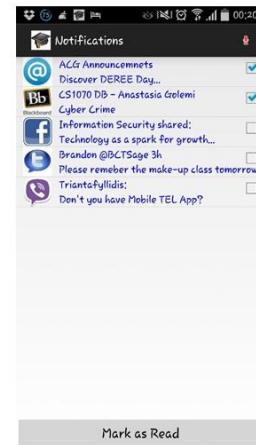
Click anywhere or press space for next slide

Get notifications from everywhere



Mobile TEL permits users to **connect** the application with a variety of on-line services including eLearning Applications, Social Networks, Messenger Services, email, SMS, etc.

That way both students and instructors will **be notified** through Mobile TEL at their mobile device for any **communication** or **update** that is related to eLearning content and activities no matter which is the chosen channel of communication.



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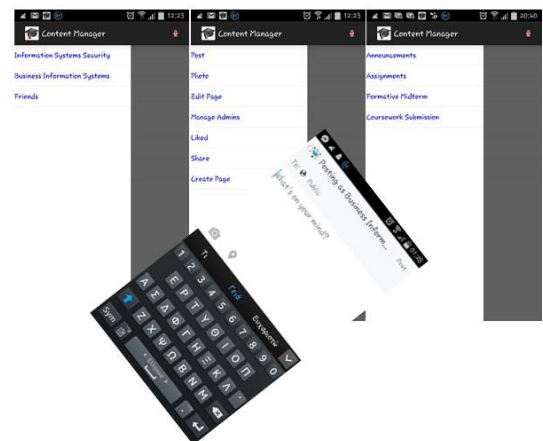
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Click anywhere or press space for next slide

Relay content everywhere



- Mobile TEL provides options to disseminate appropriate content to any close proximity device in the area like a Smart TV, a Tablet, a video projector, etc.
- Provided that the content is available in different bit rates, Mobile TEL will automatically select the one mostly suitable based on the quality of the communication between the device using Mobile TEL and the target device, i.e. a Smart TV.

Example

A student, while in a business trip, receives notification about an exercise that requires viewing a webinar first. The only device available besides his mobile phone is the hotel room TV, which offers a more suitable size to view the webinar. The student has the option to transfer the webinar to the TV at the most suitable bit rate (if available) for the TV quality of connection through Screen Mirroring for example.



Click anywhere or press space for next slide



The Interface

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Click anywhere or press space for next slide

Login and Home Screen

- Once the Mobile TEL App is executed for the first time a Login process is initiated for the application to identify the user. Thereafter the user will be remember and no future login will be required unless a reset of the device occurs.¹ At this point the user will be asked to go through settings to setup cooperating applications like Blackboard, Facebook, email, Viber, etc.
- After the Login process is completed the Home Screen is presented to the user.
There are two options available:
 - Notifications Handling
 - Content Management

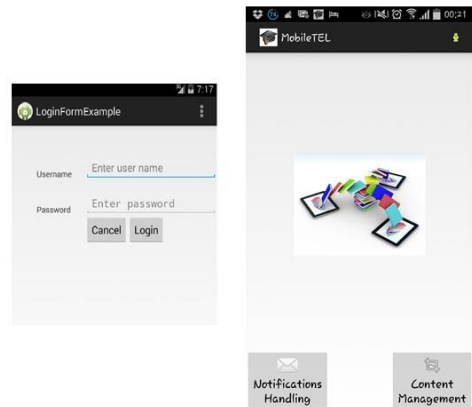
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¹ This screen is not included at the prototype
² Not available at the Mobile TEL prototype

Click anywhere or press space for next slide

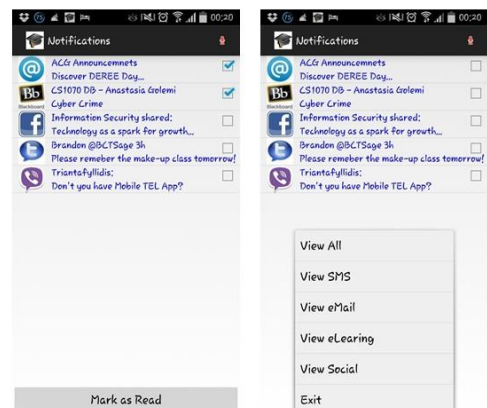


The Notifications Screen

- Notifications from all connected services filtered to course related subjects is offered are one screen.
- Mark read/unread notifications
- Device menu offers filtering of notifications by service provider.
- Voice-to-text interface available.

Aims

- No need to check multiple services anymore.
- Organize notifications based on service. Focus on a communication channel.
- Never miss an course related update or a communication again.



Click anywhere or press space for next slide

Interactivity



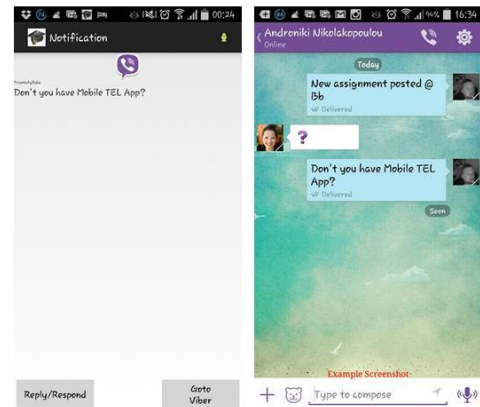
Tap on a notification and access it either directly through Mobile TEL through its corresponding native application.

Aims

- Faster response without burdening the Mobile Application with editing environment by invoking the corresponding notification originating application native mobile application

Example

- A Viber message notification is made available by Mobile TEL. (left image)
- Should the student/instructor wishes to respond the Viber Messenger native editor will be invoked to complete the process. (right image)



Click anywhere or press space for next slide

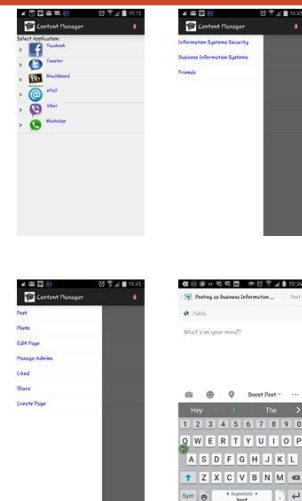
The Content Management



- Simple navigation in selecting content to create or respond to by invoking the corresponding native application.

Aims

- Common sense easy to navigate selection process.
- Organized per service content to ease and speed-up the selection process of responding to notifications.
- Fast selection of content creation/response type.



Click anywhere or press space for next slide

Integration

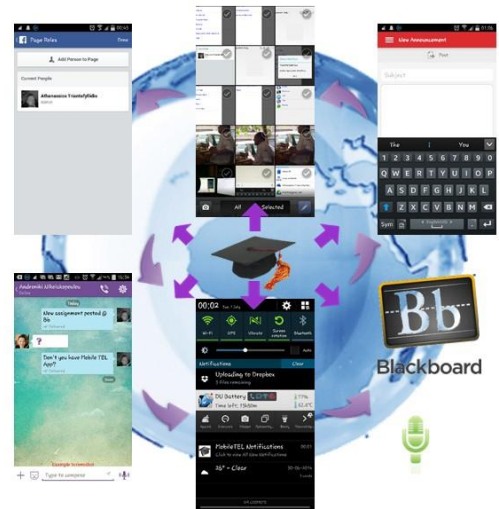


- Open architecture logic was used to design Mobile TEL to provide integration with multiple popular services and institutional LMS but also mobile provided services such as:
 - Social Networks (Facebook, Twitter, etc.)
 - LMS (Blackboard, Moodle, etc.)
 - Device notifications (Android Notifications bar & Screen)
 - Voice Command & Speech-to-text System
 - Device input interface

Aims

- By integrating course content related activities to students and faculty, the level of interactivity between class members, learning content and instructors is expected to increase dramatically.

Click anywhere or press space for next slide



In one glance

- Never miss learning related communications and updates again.
- Receive updates through multiple popular communication services without unnecessary access to the institutional eLearning system web site or the originating application.
- Respond faster to communications through Mobile TEL.
- Available everywhere disseminating content to any media device. Non-Geographically restricted.
- May be used in parallel with other tasks.
- Content may be disseminated to other more appropriate devices.
- Helpful for visually challenged people.
- Mobile TEL remains a "light" application by using existing mobile technologies.

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Mobile TEL

Bringing Learners closer through innovative use of current popular technologies creating Virtual Academic Communities.

Please proceed to the Mobile TEL Evaluation Survey 


(Click the arrow when in Slide Show mode)


Experts' Presentation Slides



For best experience...

Please switch **on** your **speakers** and adjust your volume to a higher level and close any other applications that may use your speakers.

To repeat the narration please press the **speaker**  button on the **top right side** of the slide where available. Hover on the speaker button for more options.

Some slides offer important narration in between lines. Please press the corresponding speaker  button to listen.



Click anywhere or press space for next slide



Welcome to Mobile TEL

A questionnaire will follow this presentation for you to evaluate the application.

Click anywhere or press space for next slide

Current Web-Based e-Learning offers...



Positivistic Content

- On-line announcements
- On-line course related information
 - Course policies
 - Textbook & Reading materials
 - Course Outline
 - Etc.
- On-line course related material
 - Lecture presentations
 - Links
 - Videos
 - Etc.

Constructive Activities

- On-line course related activities
 - Assessments with feedback
 - Forums or Discussion Boards
 - Wikis – Interactive Videos
 - Virtual Classrooms - Webinars
 - Etc.

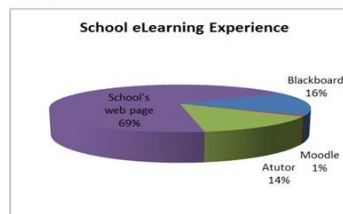
Constructive activities enable interactive engagement of students using eLearning platforms thus achieving deeper understanding of learning outcomes.

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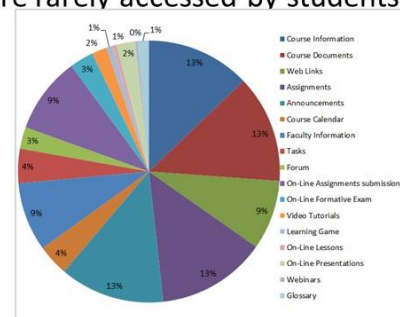
However...



Only 31% of the total population of students have experienced an LMS system



Constructive e-Learning activities are rarely accessed by students



Reference: A. Triantafyllidis, N. Clarke, P. Dowland (2012) LEARNING MANAGEMENT SYSTEMS IN HIGHER EDUCATION: A STUDENT PERSPECTIVE, *ICERI2012 Proceedings*, pp. 4046-4055.

Click anywhere or press space for next slide

Why web-based e-learning objectives are not reached?



- eLearning web sites are **not** among the top daily on-line habits of students and instructors
- Students are **not updated promptly** or at all of new e-learning activities
- Students may **not** have **access** to an appropriate or convenient device or network speed for certain learning activities or content (i.e. a pc might not be available for attending a HD webinar or a virtual classroom)
- eLearning platforms offer **limited mobile app versions** where complex activities or their features are not supported.
- e-Learning web sites are **difficult to navigate** and interact with
- e-Learning web sites are **difficult for visually impaired people**
- Instructors don't have the time to respond promptly to eLearning interactions. As a result student motivation to interact becomes lower.
- Other

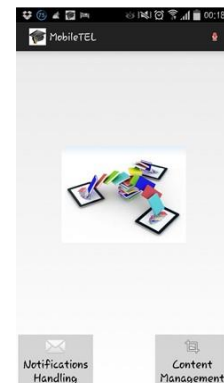


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Mobile TEL Objectives



- To achieve eLearning updates **awareness** at any time at any place.
- To **minimize the time** it takes to respond to any eLearning or course related activity.
- To effectively **utilize multiple channels of communication** including social networks, messenger applications, SMS, etc.
- To **increase interactivity** of both students and instructors with eLearning activities.
- To **assist** visual impaired people but also achieve parallel use of the app with other tasks by enabling a voice-to-text system



Click anywhere or press space for next slide

Never miss updates again

Mobile TEL ensures that the learning community (students and instructors) will **always be updated** on changes in eLearning content and activities:

- **Ubiquity** – Receive Notifications about updates **everywhere** through your mobile device (smartphone, tablet)
- **Integration** – Mobile TEL **aggregates and pushes content** from your College eLearning site or any other on-line service used for learning, through a variety of popular services like Facebook, Twitter, Blackboard, Viber, WhatsApp, eMail, SMS, etc. That way, no matter what channel is used for communication, you will get it all, once you use your mobile device.



Click anywhere or press space for

Work Together

- By keeping class members updated on eLearning activities and content, Mobile TEL increases the **interactivity** and **collaboration** of class members even when not in class!
- It creates a feeling of being member of a **Learning Community**.



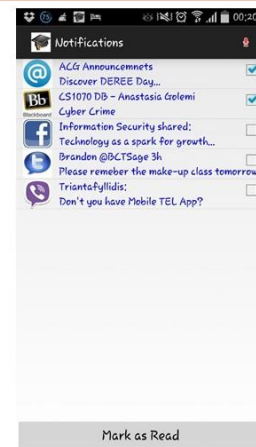
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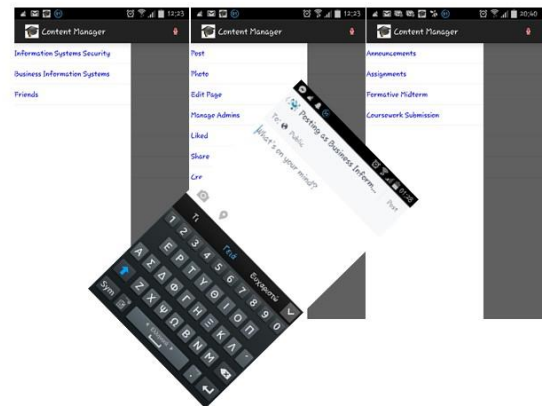
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Click anywhere or press space for next slide

Relay content everywhere



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Example

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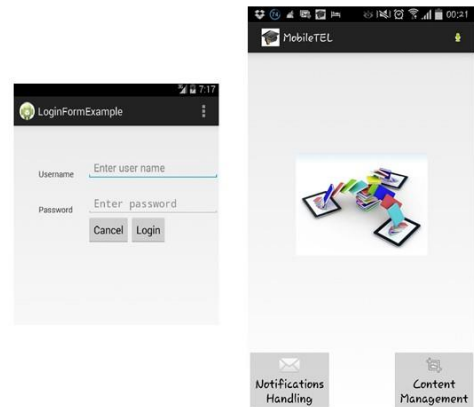
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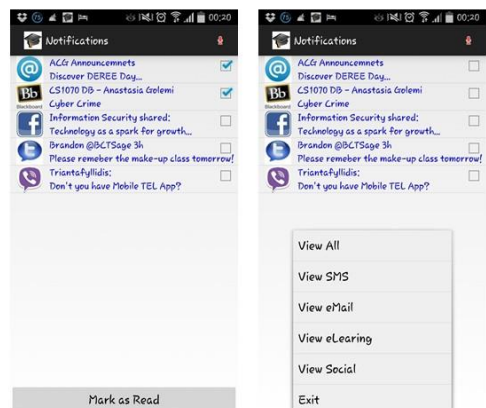
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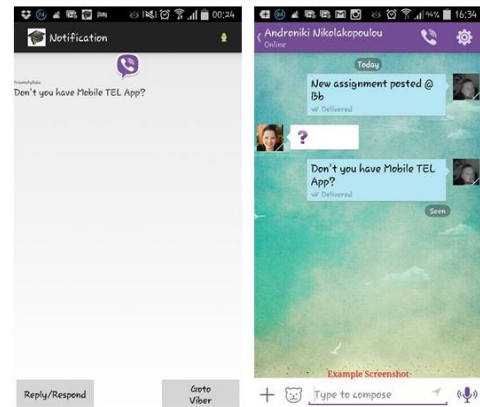
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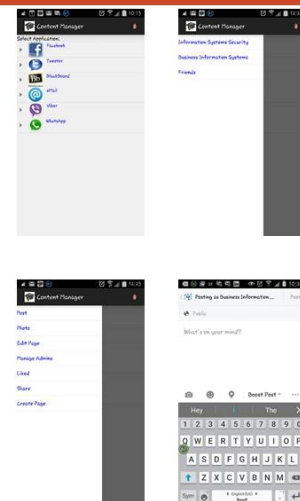
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Integration

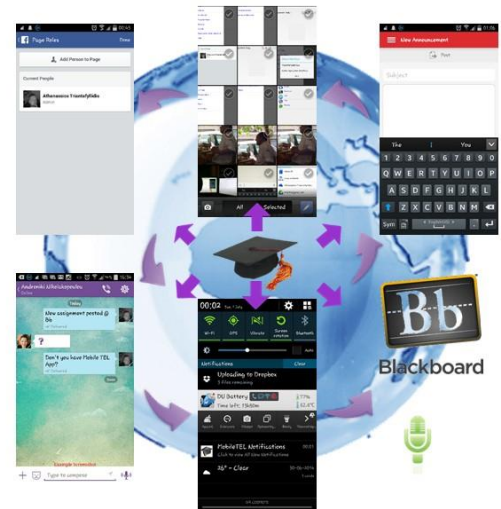


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Technologies

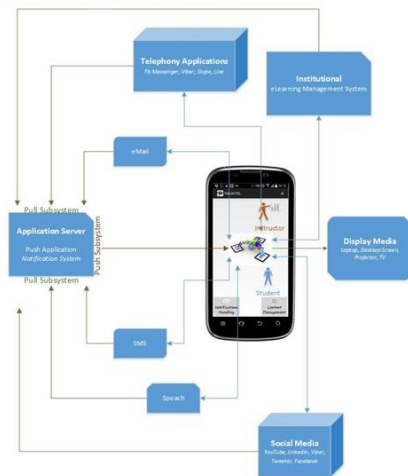
In this section basic technological functions of the theoretical design of the Mobile TEL application will be illustrated.

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Mobile TEL Technologies in a glance



- Utilization of existing technologies
- eLearning Web Platform Integration
- Mobile Communications and Social Media Integration
- Push Notification Web Application
- Best Media Content Selection
- Mobile Voice Command & Speech-to-Text enabled system



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Utilization of existing mainstream mobile apps & services



Mobile TEL is mostly a “ghost” application with a minimal setup and notification interface. It uses existing mainstream mobile apps (i.e. Facebook, Viber, email, etc.), mobile devices’ services (i.e. SMS, Voice Command System, etc.) and a web server application for collecting and disseminating activities and content from and to all cooperating apps.

Aims

- A very light and low energy consuming application. It does not consume much memory, processing time and energy.
- It is using existing mobile apps and services, hence upgrading and maintenance costs are very low since they are transferred to the cooperating apps.

Click anywhere or press space for next slide

E-Learning Web Platform Integration



Any activity that occurs at the institutional web-based e-Learning Platform is disseminated via Mobile TEL to all connected mobile applications and services of the user's device with the ability to respond where applicable.

Example

An instructor creates a thread at a discussion board (forum) in Bb. A notification about this is produced in Mobile TEL and through it is disseminated to all connected mobile applications and services (i.e. Fb, Viber, email, SMS, etc.) of the Mobile TEL's user. All users may post-reply to this thread using Mobile TEL or any connected service/app they used to receive it.



Click anywhere or press space for next slide

Social Networks Integration



Social Networks are so popular for people and definitely for students, that they serve as the main method of their daily communication and socialization. Additionally, many instructors hold course related pages on them.

Mobile TEL offers the technology to keep learners updated of any learning activities occurring in such pages.

Example

A student places a course related question at the status of a Facebook page. Mobile TEL will create a notification about that and will disseminate it to all learners through their device collaborating mobile apps with the ability to respond directly from the app used to view it.



Click anywhere or press space for next slide

Push Notification Web Application



A web server application undertakes the task to check all Mobile TEL collaborating applications (i.e. Facebook, Viber, twitter, Blackboard, etc.) for new updated related content. Once updates are found they are pushed to the Mobile TEL mobile app and cooperating services.

Rationale

All updating monitoring occurs at a web server. Consequently, Mobile TEL is off-loaded from this task economizing network load and battery consumption.



Click anywhere or press space for next slide

Best Media Content Selection



When a notification about updated content is received by Mobile TEL, the application offers the option, not only to access this content but also wirelessly forward it to a more suitable device in the area such as a TV or a projector. Depending on the available wireless methods but also on whether the content is available in multiple versions, Mobile TEL will choose the most appropriate one.

Example

A learner that wants to attend a webinar may forward it from their smart phone to a smart TV in the room via Bluetooth. Mobile TEL will check if the content is available in a low bit-rate version and will choose that as most appropriate for the available means of communication.



Click anywhere or press space for next slide

Voice Command enabled system



Finally, Mobile TEL utilizes the Voice Command and text-to-speech system available by mobile devices to permits its users to fully utilize the applications functionality via voice commands and speech-to-text conversion.

This option may be enabled automatically if the phone detects that the user is driving if the accelerometer is enabled at the setting of Mobile TEL.

Rationale

Learners may use Mobile TEL at the same time with other tasks. Since research has shown that lack of time is one of the main reasons instructors but also learners do not engage to e-learning activities, this option is expected to resolve this issue and furtherly increase e-learning activities engagement.

Example

A learner may access and use Mobile TEL while driving.



Click anywhere or press space for next slide



Mobile TEL

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Please proceed to the Mobile TEL Evaluation Survey 

(Click the arrow when in Slide Show mode)

Appendix III – Survey Questions



**Welcome to the Electronic Learning Course Management Systems
Productivity Survey for Students in Higher Education.**

Researcher: Athanassios Triantafyllidis This survey aims to evaluate the productivity of the Virtual Learning Environments (i.e. Blackboard/AcgBoard, etc.), so that we may be able to improve the effectiveness and efficiency of on-line web educational services. This survey is intended to collect information only from Students in Higher Education. Your cooperation is very important. Thank you for participating! *A note on privacy This survey is anonymous. The record kept of your survey responses does not contain any identifying information about you. Additionally, participants may withdraw from this survey at any time they chose to by pressing the button at the bottom of the screen. In such case no record of the participant's answers will be stored. Should you feel coerced at any time during the survey process please contact Associate Dean of the School of Business Administration Ms Vilma Sinanoglou at vsinanoglou@acg.edu.* This survey has been approved by both DERE and University of Plymouth Ethics Committees. Please press below, only if you AGREE to the above terms.

Section A: Demographics

A1. What is your gender?

Remember the survey is anonymous and there is no possible way that the data you

Male ☐
Female ☐
No Answer ☐




A2. What is your age?

Remember the survey is anonymous and there is no possible way that the data you provide will be exposed to the public.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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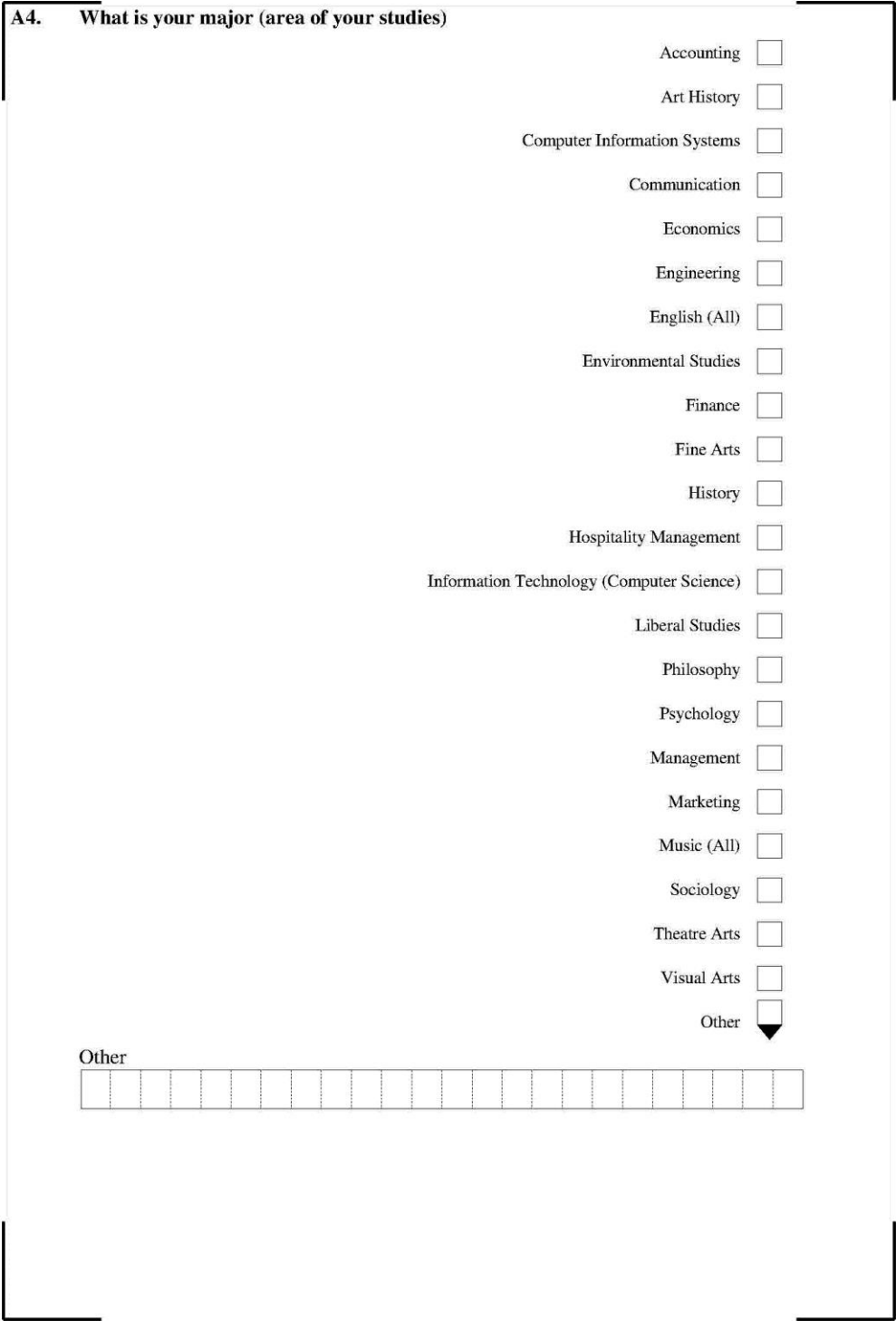
A3. Your High School was a...

Public School (Greece) ☐Private School (Greece) ☐Public School (Europe except Greece) ☐Private School (Europe except Greece) ☐Public School (North America) ☐Private School (North America) ☐

Other 

Other

[illegible]



B1. Where do you access Internet from?

Other

[illegible]


Other

[illegible]

Other

[illegible]

C1.	Have you used any on-line Learning tool before Higher Education?
-----	--

Moodle VLE 

ATutor


No I haven't used any on-line school resources ☐

Other

[illegible]

*Higher Education: College, University, Polytechnic.

Choose the one you have most extensively used.

Blackboard LMS ☐Moodle VLE Second Life On-Line Campus Classes ☐

I do not know any of the above ☐

I have heard of the above systems but never used one ☐

Other

[illegible]



Section D: Blackboard LMS

Questions Relevant to Blackboard LMS usage.

D1. Which of the following Blackboard common functions have you used in Blackboard LMS?

Please answer as many functions as you are certain to remember that you have used. If you are in doubt about the what a function does or the function was provided with a different name please seek below for a more detailed description of the corresponding tool. If you are still in doubt, please do not check the corresponding answer. You must have used to select it. If you have just seen it, but never used it, please do not check the corresponding answer.

Course Information: May include Textbook information, Course Outline, Absence Policy, Student Evaluation Method, Syllabus, Academic Integrity Information, etc.

Course Documents: May include Marking Scheme, Coursework Description, Project Requirements, Coursework Cover Pages, Instructions about Assignments, etc.

External Links: Web links to sites relevant to the course.

Assignments: May include an on-line test, a Turnitin Submission of a paper or a Survey.

Faculty Information: May include contact and office hours information for your instructor.

Tasks: Information and reminders about deadlines.

Discussion Board: Provides with the ability to post questions and receive answers from any member of the course such as an off-line discussion. Also known as Forum.

On-Line Assignments Submission: Area where students may submit an assignment file at a certain deadline.

On-Line Exam: Take an on-line Exam with immediate feedback on the expected correct answers for the questions asked, immediate correction for questions except essays. Such exams maybe take home formative exams or in class exams.

Video Tutorials: Pod Casts of tutorials. In several cases the student may have the opportunity to repeat a class at home, or watch a video for a class they have skipped.

Learning Games: Interactive games that provide learning through an entertaining environment.

On-Line Lessons: Structured Material presented in a predefined order. May include instructions, documents, presentations, pod casts, etc.

On-Line Presentations: Slide presentations that may be watched on-line or downloaded.

Webinars: Real time classes at an agreed time where an instructor and students meet on-line to perform a task such as discussing a case study or do an exercise. Collaboration tools such as a whiteboard and conferencing systems may be used.

Glossary: An index of terms used for the course.

Course Information ☐

Course Documents ☐

External Links (Web Links) ☐

Assignments ☐

Announcements ☐

Course Calendar ☐

Faculty Information ☐

Tasks ☐

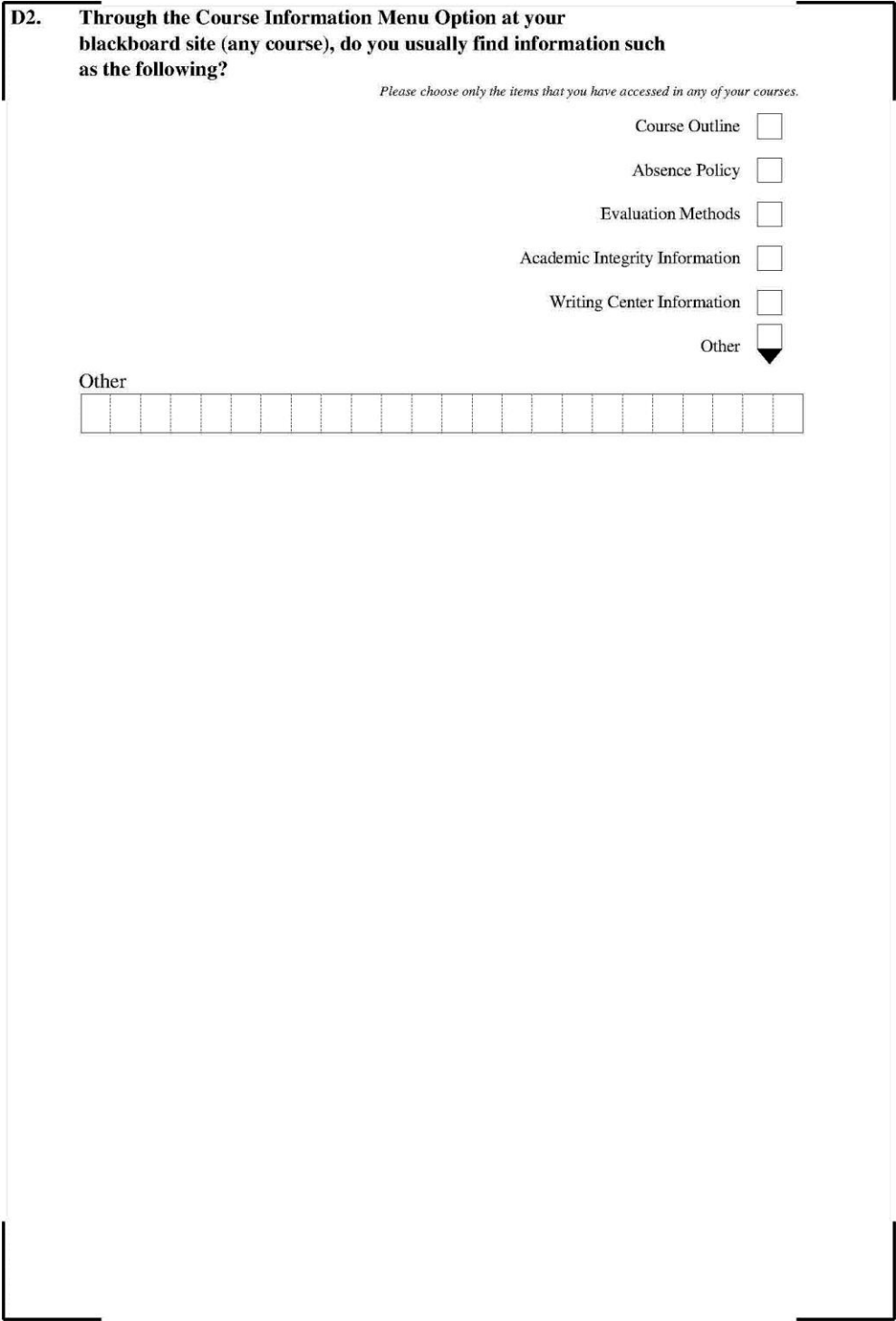
Discussion Board - Forum ☐

On-Line Assignments, Coursework, Exercises, etc., submission ☐

On-Line Formative Exam ☐

Video Tutorials ☐

Learning Games ☐



Blackboard, check which of the following items you have accessed.

Course Presentation Files ☐Course Notes ☐

Course Coursework Description	
-------------------------------	--

Audio Tutorials or Complementary Audio Files ☐

Video Tutorials or Complementary Video Files ☐Lab Documents ☐Instructions for Exercises ☐Other ☐

Other

[illegible]

Consider all courses you have taken so far.

Links to websites relevant to the course (i.e. corporate, organisations, academic, etc.)

Links to on-line college/university services (i.e. College/University Web Site, Registration, Mail, etc.) ☐

Other

Other

[illegible]

1 I haven't seen this option, 2 No one updates this, 3 Few Update this, 4 Most Update this, 5 All have updated this

How many instructors, whose courses you have attended, have updated current information at this area

1 I haven't seen this option, 2 No one updates this, 3 Few Update this, 4 Most Update this, 5 All have updated this

Consider that Instructors may provide the above information through a Menu Option with similar or different name. Still, please, provide an answer.

How many Instructors, whose courses you have attended, would you consider that have updated current Information about the course in this area?

A diagram showing a 5-stage pipeline. Five rectangular blocks are arranged horizontally, representing the stages. Above each block is a number: 1, 2, 3, 4, and 5. Dashed lines connect the right side of one stage to the left side of the next stage, indicating the flow of data between them.

**D7. Considering the Course Documents Menu option at Blackboard...**

1 No one updates this, 2 Few update this, 3 Many Update this, 4 Most Update this, 5 All have updated this

How many Instructors, whose courses you have attended, would you consider that have updated current information in this area? In other words, how many Instructors make available all course related documents through Blackboard even if the Menu Option used to access them has a different name than Course Documents?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

D8. Considering the Course Calendar function of Blackboard to announce and notify about deadlines and events...

1 No one updates this, 2 Few update this, 3 Many update this, 4 Most Update this, 5 All have updated this

How many instructors, whose courses you have attended, use this?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

D9. Considering the Discussion Board (Forum) function of Blackboard...

1 No course uses this, 2 Few courses use this, 3 Many courses use this, 4 Most courses use this, 5 All courses are using this

How many Instructors, whose courses you have attended, would you consider to use this?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

D10. Considering the Glossary application of Blackboard,,,

1 No one updates this, 2 Few update this, 3 Many update this, 4 Most Update this, 5 All have updated this

How many instructors, whose courses you have attended, would you consider to update this?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

D11. Considering Blackboard containers (course sites) that you have used to access Video Tutorials...

1 I haven't seen this option, 2 I show such tutorials only in one course so far, 3 I show such tutorials only in few courses so far, 4 Many courses use such tutorials in Blackboard, 5 All courses use such tutorials in Blackboard

How many courses have you seen to use Video Tutorials?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐



D12. Consider the following Blackboard functions. Please evaluate only those you have used in any of your classes.

1: Never seen it 2: Seen it but never used it 3: Used it because it was Mandatory 4: Used on my own initiative and was helpful 5: Used it and it was very helpful

Please answer for as many functions as you are certain to remember that you have used. If you are in doubt please seek below for a more detailed description of the corresponding tool. If you are still in doubt, please evaluate with 1. You must have used a tool to evaluate it. If you have just seen it, but never used it, please evaluate it with 2.

Course Information: May include Textbook information, Course Outline, Absence Policy, Student Evaluation Method, Syllabus, Academic Integrity Information, etc.

Course Documents: May include Marking Scheme, Coursework Description, Project Requirements, Coursework Cover Pages, Instructions about Assignments, etc.

External Links: Web links to sites relevant to the course.

Assignments: May include an on-line test, a Turnitin Submission of a paper or a Survey.

Faculty Information: May include contact and office hours information for your instructor.

Tasks: Information and reminders about deadlines.

Discussion Board: Provides with the ability to post questions and receive answers from any member of the course such as an off-line discussion. Also known as Forum.

On-Line Assignments Submission: Area where students may submit an assignment file at a certain deadline.

On-Line Exam: Take an on-line Exam with immediate feedback on the expected correct answers for the questions asked, immediate correction for questions except essays. Such exams maybe take home formative exams or in class exams.

Video Tutorials: Pod Casts of tutorials. In several cases the student may have the opportunity to repeat a class at home, or watch a video for a class they have skipped.

Learning Games: Interactive games that provide learning through an enteriaining environment.

On-Line Lessons: Structued Material presented in a predifined order. May include instructions, documents, presentations, pod casts, etc.

On-Line Presentations: Slide presentations that may be watched on-line or downloaded.

Webinars: Real time classes at an agreed time where an instructor and students meet on-line to perform a task such as discussing a case study or do an exercise. Collaboration tools such as a whiteboard and conferencing systems may be used.

Glossary: An index of terms used for the course.

	1	2	3	4	5
Course Information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Course Documents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
External Links	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assignments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Announcements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Course Calendar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faculty Information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tasks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Discussion Board - Forum	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
On-Line Assignments, Coursework, Exercises, etc., submission	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
On-Line Formative Exam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



D13. Considering all Blackboard containers you have used for your courses, which Major (program or area of studies) or Faculty do you think mostly uses these tools. Which are the Majors with the richest containers?

1: Not used at all 2: Containers are very poor 3: Only basic Information and files available 4: Rich in terms of information and files 5: Very rich Information, Files, Video Tutorials, Collaboration, etc.

	1	2	3	4	5
Accounting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer Information Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Economics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Finance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fine Arts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
History	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hospitality Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information Technology (Computer Science)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Liberal Arts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Psychology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marketing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Music	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sociology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



D14. Considering all Blackboard containers you have used for your courses, which of the following courses do you think is mostly using eLearning tools?

1: Not used at all 2: Containers are very poor 3: Only basic Information and files available 4: Rich in terms of information and files 5: Very rich Information, Files, Video Tutorials, Collaboration, etc.

In case you have not taken a course in the above list please answer 1.

	1	2	3	4	5
EN 1111 Academic Writing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CN 3940 Communication Seminar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HT 2116 Hospitality Information Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IB 4444 International Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CN 4545 Advanced Media Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AF 3319 International Financial Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MK 2050 Principles of Marketing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AF 3105 Principles of Finance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CS 2240 Electronic Commerce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EC 1000 Principles of Microeconomics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MG 4740 Business Strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MK 4860 Marketing Topics and Strategies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CS 1070 Introduction to Information Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ES 3435 Sustainable Use of Resources and Waste Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MA 1001 Finite Mathematics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HT 4332 Event Management for the Hospitality Industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PH 2005 Business Ethics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you for participating at this survey!

eLearning in Higher Education: A Survey of their Effectiveness

Research program by **Plymouth University**, sponsored by **DEREE College**.



Welcome to the *Electronic Learning Course Management Systems Productivity Survey for Faculty of Higher Education.*

Researcher: Athanassios Triantafyllidis

This survey aims to evaluate the productivity of the Virtual Learning Environments (i.e. Blackboard/AcgBoard, Moodle, etc.), so that we may be able to improve the effectiveness and efficiency of on-line web educational services.

This survey is intended to collect information **only** from **Faculty** of Higher Education.

Your cooperation is very important. Thank you for participating!

A note on privacy

This survey is anonymous.

The record kept of your survey responses does not contain any identifying information about you. Additionally, participants may withdraw from this survey at any time they chose to by pressing the <Exit and clear survey> button at the bottom of the screen. In such case no record of the participant's answers will be stored. By clicking <Next> below you are consenting to undertaken this survey. Should you feel coerced at any time during the survey process or have any questions please contact [Athanassios Triantafyllidis](#).

This survey has been approved by both DERE E and Plymouth University Ethics Committees.

Please press <Next> below, **only if you AGREE** to the above terms.

There are 23 questions in this survey

Demographics

1 [D1]Please select your gender.

Please choose **only one** of the following:

- ☐ Male
- ☐ Female

2 [D2]Please select your appropriate age group.

Please choose **only one** of the following:

- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65 or over

Remember the survey is anonymous and there is no possible way that the data you provide can be matched to you or be exposed to the public.

3 [D3]Please select your topic area or discipline (department).

Please choose **only one** of the following:

- ☐ Accounting
- ☐ Archaeology
- ☐ Art History
- ☐ Computer Information Systems
- ☐ Communications
- ☐ Economics
- ☐ Engineering (All)

- ☐ English (All)
- ☐ Environmental Studies
- ☐ Finance
- ☐ Fine Arts
- ☐ History
- ☐ Hospitality Management
- ☐ Finance
- ☐ Fine Arts
- ☐ History
- ☐ Hospitality Management
- ☐ Information Technology (Computer Science)
- ☐ Law
- ☐ Liberal Studies
- ☐ Public Relations
- ☐ Pharmaceutical Sciences
- ☐ Philosophy
- ☐ Psychology
- ☐ Management
- ☐ Marketing
- ☐ Medicine
- ☐ Medical Professions
- ☐ Music (All)
- ☐ Natural Sciences (Astrophysics, Biology, Chemistry, Geology, Physics, etc.)
- ☐ Sociology
- ☐ Theatre Arts

☐ Visual Arts

☐ Other

If you are teaching in more than one area please select your primary area.

4 [D4] You are faculty of

Please choose **only one** of the following:

☐ Deree College

☐ Plymouth University

☐ UK Higher Education Institution (other than Plymouth)

☐ Greek Public Higher Education Academic Institution

☐ Greek Private Higher Education Academic Institution (not Deree)

☐ Other

Internet Access

5 [I1] Please select the highest approximate speed with which you connect to Internet at your office.

Please choose **only one** of the following:

☐ Less than or equal to 2Mbps

☐ 2-24Mbps

☐ More than 24Mbps

6 [I2] Please select the highest approximate speed by which you connect to the internet everywhere else.

Please choose **only one** of the following:

☐ Less than or equal to 2Mbps

☐ 2-24Mbps

☐ More than 24Mbps

☐ I do not know

Mobile access, Hi-Fi spots (library, faculty rest area, etc), Home (earth-line)

7 [I3] Does your office offer a suitable environment where you can engage in research or other creative academic work?

Please choose **only one** of the following:

☐ Yes

☐ No

By suitable consider your own space, required resources, a place that is quiet enough so you can focus on the areas of your interest.

Web CMS

8 [CMS1] Are you using any eLearning web based software at your organization?

Please choose **only one** of the following:

☐ Yes

☐ No

9 [CMS2] Which of the following web-based applications are you using?

Only answer this question if the following conditions are met:

Please choose **all** that apply:

☐ Blackboard LMS

☐ Moodle VLE

☐ Second Life On-Line Classes

☐ SharePoint

☐ I have heard of the above systems but never used one

☐ We do have an installation of an eLearning system but I am not using it

☐ Other:

10 [CMS3] Which of the following common web elearning functions have you used for your courses?

Please choose **all** that apply:

- ☐ Course Information
- ☐ Course Documents
- ☐ External Links (Web Links)
- ☐ On-Line Assignments, Coursework, Exercises, etc., submission
- ☐ Announcements
- ☐ Course Calendar
- ☐ Faculty Information
- ☐ Tasks
- ☐ Discussion Board - Forum
- ☐ On-Line Formative or other Exam
- ☐ Video Tutorials
- ☐ Learning Games
- ☐ On-Line Lessons
- ☐ On-Line Presentations
- ☐ Webinars
- ☐ Glossary
- ☐ Blogs
- ☐ Journals
- ☐ Wikis
- ☐ Other:

Please answer as many functions as you are certain to remember that you have used. If you are in doubt about the what a function does or the function was provided with a different name please seek below for a more detailed description of the corresponding tool. If you are still in doubt, please do not check the corresponding answer. You **must** have **used** to **select** it. If you have just seen it, but never used it, please do not check the corresponding answer.

Course Information: May include Textbook information, Course Outline, Absence Policy, Student Evaluation Method, Syllabus, Academic Integrity Information, etc.

Course Documents: May include Marking Scheme, Coursework Description, Project Requirements, Coursework Cover Pages, Instructions about Assignments, etc.

External Links: Web links to sites relevant to the course.

Assignments: May include an on-line test, a Turnitin Submission of a paper or a Survey.

Faculty Information: May include contact and office hours information for your instructor.

Tasks: Information and reminders about deadlines.

Discussion Board: Provides with the ability to post questions and receive answers from any member of the course such as an off-line discussion. Also known as Forum.

On-Line Assignments Submission: Area where students may submit an assignment file at a certain deadline.

On-Line Exam: Take an on-line Exam with immediate feedback on the expected correct answers for the questions asked, immediate correction for questions except essays. Such exams maybe take home formative exams or in class exams.

Video Tutorials: Pod Casts of tutorials. In several cases the student may have the opportunity to repeat a class at home, or watch a video for a class they have skipped.

Learning Games: Interactive games that provide learning through an entertaining environment.

On-Line Lessons: Structured Material presented in a predefined order. May include instructions, documents, presentations, pod casts, etc.

On-Line Presentations: Slide presentations that may be watched on-line or downloaded.

Webinars: Real time classes at an agreed time where an instructor and students meet on-line to perform a task such as discussing a case study or do an exercise. Collaboration tools such as a whiteboard and conferencing systems may be used.

Glossary: An index of terms used for the course.

Blog: Students may provide text in the same one area which is accessible by all. This text can only be edited by its author. Comments and evaluation may be enabled.

Journal: Each student has its own area to provide text. This area may be accessible to all for reading. Comments and evaluation may be enabled.

Wikis: A student may provide text that is accessible and can be altered (edited) by all members of the class improving it to an optimum state. Comments and evaluation may be enabled.

11 [CMS4] Provided that you offer a Course Information Option at your elearning CMS site (any course), do you usually offer information such as the following?

Please choose **all** that apply:

- ☐ Course Outline
- ☐ Absence Policy
- ☐ Evaluation Methods
- ☐ Syllabus
- ☐ Departmental/Organization Information
- ☐ Office Hours
- ☐ Textbook Information
- ☐ Other:

Please choose only the items that you have used for your courses.

A Course Information Option would be an area in your Learning Management System that stores documents that offer Information relevant to the course policies, needs or requirements such as the options available to the this question.

12 [CMS5] Which of the following files do you make available through your web-based eLearning application?

Please choose **all** that apply:

- ☐ Course Presentation Files
- ☐ Course Notes
- ☐ Course Coursework Description
- ☐ Audio Tutorials or Complementary Audio Files
- ☐ Video Tutorials or Complementary Video Files
- ☐ Lab Documents
- ☐ Instructions for Exercises
- ☐ Other:

13 [CMS6]

Have you ever utilised a third-party elearning tool to facilitate your teaching (i.e. have you used blogs or wikis that are not supported by your institution)?

Please choose **only one** of the following:

- ☐ Yes
- ☐ No

Evaluation Questions

14 [ET1] Have you received any training relative to the eLearning Course Management System (Blackboard, Moodle, ATutor, etc.) of your organization?

Please choose **only one** of the following:

- ☐ Yes
- ☐ No

15 [ET2] Do you consider that the training you have received was adequate in terms of length/time?

Please choose **only one** of the following:

- ☐ Yes the length of the training was sufficient.
- ☐ Yes, but some more training would be better to cover some details.
- ☐ The training covered the application from all technical aspects but time should have been provided with respect to the educational implementation of the application features.
- ☐ No the training was insufficient. I still have difficulty implementing the basics.
- ☐ Other

16 [ET4] Please select which of these groups mostly represents the person that did the training in your case:

Please choose **only one** of the following:

- ☐ An Information Technology expert experienced in Learning Management Systems
- ☐ An Information Technology member of the faculty with experience in using the Learning Management System in his/her courses
- ☐ A faculty member with background in IT and Education (i.e. graduate degree in IT, postgraduate degree in Education or the opposite)
- ☐ A training consultant available through the software company vendor of your organization's Learning Management System (like Blackboard tutors)
- ☐ No training was offered for me to participate
- ☐ Other

If you actually know the background of your trainer please do not answer based on this knowledge. Answer based on your feel on how training was deliver, even better, as if you didn't know the background of the trainer.

Should you feel that any of the above answers is vague please consider the following help tips corresponding to each of the above questions:

A trainer absolutely perfectly equipped to all technical aspects of the application. However, may fail to communicate how many features would be implemented in a way to enhance student learning. He/She may not be able to deliver real-life examples for several features.

The colleague may possibly offer sufficient technical expertise and provide examples from the implemented features in his/her courses. However, he/she may be unable to offer training in features that he/she not uses.

A colleague that due to their background, he/she may have high level of technical perception of the application while at the same time their educational background may have provided the knowledge to offer with educational ideas and examples on how to implement eLearning features.

Usually such technical consultants have good technical understanding while they have been trained (mostly through short seminars or conferences) in several aspects related to the application they represent, usually including educational approaches to Learning Management Systems.

17 [ET5]

Please evaluate the following statements regarding your training needs:

Please choose the appropriate response for each item:

	1	2	3	4	5
General training in information technologies with focus on learning applications and other required software	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Training specifically related to the learning application used by my organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Training in pedagogy and education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Multiple training sessions in information technology, learning software and pedagogy and education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1 I need no training, 2 I need some training 3, I need basic training, 4 I need sufficient training, 5 I need expert training

18 [ET6] Please select the terms you are familiar with.

Please choose the appropriate response for each item:

	Yes	Uncertain	No
Positivism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wiki	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Videotutorial Authoring Software	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Virtual Classroom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Webinar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Constructivism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Yes	Uncertain	No
STAR Legacy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forum	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learning Blog	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learning Journal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19 [ET7] Given that you use an eLearning system for your courses, how would you evaluate its benefits to your students.

Please choose the appropriate response for each item:

	1	2	3	4	5
In terms of information dissemination and repository of material service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In terms of understanding learning objectives of the course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In terms of availability and access to materials by students at any time from any place	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In terms of distance learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 No difference compared to not using LMS (indifferent) 5 Major difference (optimum)					

20 [ET8] According to a survey in higher education students 35% of students claim they have never seen any Technology Enhanced Learning (TEL) implemented for their courses. Do you think that this happens because:

Please choose the appropriate response for each item:

	1	2	3	4	5
Faculty does not have enough time to implement TEL solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty does not have enough IT training to implement TEL solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty does not understand how to implement TEL solutions from an educational/pedagogical perspective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is not enough classroom time to initiate tasks that lead to TEL implemented applications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are several complementary applications that are not available (i.e. video authoring tools, SCORM generators, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1: least important | 2: somewhat important | 3: important | 4: quite important | 5: very important

21 [ET9] According to the same survey, an average of 70% of students is using TEL web applications only to retrieve files and documents required for their course. Only 30% of the students had been exposed to more advanced elearning features such as video tutorials, forums, journals, wikis, etc. Do you think that this happens because:

Please choose the appropriate response for each item:

	1	2	3	4	5
Faculty does not have enough time to implement TEL solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty does not have enough IT training to implement TEL solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty does not understand how to implement TEL solutions from an educational/pedagogical perspective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is not enough classroom time to initiate tasks that lead to TEL implemented applications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are several complementary applications that are not available (i.e. video authoring tools, SCORM generators, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I didn't know there were such features	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The application we are using for TEL does not support such features	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1: least important | 2: somewhat important | 3: important | 4: quite important | 5: very important

22 [ET10]

Please answer Yes if you have to recreate all content made available through your organizational elearning application at the beginning of every academic period.

Please answer No if you just have to update the content made available through your organizational elearning application at the beginning of every academic period.

Please choose **only one** of the following:

☐ Yes

☐ No

23 [ET11] Does your institution have a department that is specialized in developing elearning strategies?

Please choose **only one** of the following:

☐ Yes (Like the one described at the help or similar)

☐ No (Just technical support by the IT department as with all other IT services)

☐ We do have a department responsible for learning but not specifically elearning

☐ I am not sure

A department like this would be responsible in designing, supporting and maintaining elearning content using Technology Enhanced Learning (TEL) systems. They would also be responsible for training faculty and offer seminars to students on the use of the implemented TEL systems. Their staff would normally be a mix of IT experts in TEL and experienced educators with TEL.

Thank you for participating at this survey!

Mobile TEL Conceptual Application Evaluation Survey

<http://eproject.gr/limesurvey/index.php/survey/index/sid/995916/newte...>**Mobile TEL Conceptual Application Evaluation Survey**

Mobile TEL* Conceptual Application Evaluation Survey for the Higher Education community by Plymouth University, sponsored by Deree College.

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*TEL: Technology Enhanced Learning

This survey aims to evaluate a Mobile TEL Conceptual Application designed for students and instructors in Higher Education Institutes. The survey is made available to members of higher education institutes (students & instructors) after they have seen a presentation of Mobile TEL Application.

Please use the link above to view the presentation.

A note on privacy: This survey is anonymous. The record kept of your survey responses does not contain any identifying information about you. Additionally, participants may withdraw from this survey at any time they chose to by pressing the corresponding button at the bottom of the screen. In such case no record of the participant's answers will be stored. Should you feel coerced at any time during the survey process please contact Professor [Athanasios Triantafyllidis](#), CIS Department, Deree College.

There are 47 questions in this survey.

[Load unfinished survey](#)

[Next](#)

[Exit and clear survey](#)

This survey is currently not active. You will not be able to save your responses.

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Survey Entry Status Identification

*** Please state your status:**
Choose one of the following answers

☐ Student

☐ Instructor

[Resume later](#) [Next](#) [Exit and clear survey](#)

This survey is currently not active. You will not be able to save your responses.

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Faculty Demographics

• **What is your Gender?**

☐ Female ☐ Male

• **Do you use any of the following devices?**
Check any that apply

☐ Laptop/Note
☐ Tablet
☐ Smart Phone
☐ Other:

? Laptop: a computer that is portable and suitable for use while travelling.
Tablet: a small portable computer that accepts input directly on to its screen rather than via a keyboard or mouse.
Smartphone: a mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, Internet access, and an operating system capable of running downloaded apps.

• **Please state the type of the Operating System your desktop or laptop is using?**
Check any that apply

☐ MS Windows (for desktops, laptops, etc.)
☐ MacOS
☐ Linux
☐ Other:

• **Please state the type of the Operating system your Mobile devices use (Smartphone, Tablet, etc.):**
Check any that apply

☐ iOS (iPhones & other apple devices)
☐ Android (Samsung, HTC, Lenovo, Nexus, etc.)
☐ Mobile Windows
☐ Other:

? Should you use more than one please select the one you use more frequently.

• **Do you use downloaded applications at your smartphone/tablet?**

☐ Yes ☐ No

? Examples may include Facebook, LinkedIn, Blackboard Mobile, Google+, OneDrive, Viber, Whatsapp, etc.

• **Which of the following web/mobile services do you use?**
Check any that apply

☐ Facebook
☐ Blackboard
☐ LinkedIn
☐ Twitter
☐ YouTube
☐ Any messenger service (Viber, Whatsapp, Facebook Messenger, etc.)

- ☐ Any Cloud service (OneDrive, DropBox, Google Drive)
☐ Any other eLearning service
☐ I do not use any such service
☐ Other: _____

? Select the ones in which you have an active profile irrelevantly to whether you use it via a mobile device or a desktop/laptop computer.

Examples may include Facebook, LinkedIn, Blackboard Mobile, Google+, OneDrive, Viber, Whatsapp, etc.

***** Have you connected your profile in any of the Internet services you are using with that of any of your students?

☐ Yes ☐ No

? For example, if you are using Facebook, do you have any Instructors of yours in your friend list?

***** How often do you use (access either through a mobile or desktop device) any of the following sites/services?

	Facebook	Twitter	Blackboard	eMail	SMS	Google+	Facebook Messaging Service	Viber	WhatsApp	Google Hangouts	Other Services/Sites/Apps
Several times in a day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Several times in a week	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maybe a few times in a month	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rarely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't have an Account/Don't use it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

?

Please remember that the survey is anonymous, so please answer honestly!

***** Which platform do you use most frequently to access the following sites/services/apps?

	FaceBook	Twitter	Blackboard	Google+	Skype	Viber	Facebook Messaging Service	Viber	Google Hangouts
Desktop/LapTop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tablet/Smart Phone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***** When you visit/access the following sites/services, how much time do you spend approximately each time in most cases?

	Facebook	Blackboard (or any other LMS)	Google+	Twitter
Some few minutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1-2 Hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2-3 Hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Don't use the site/service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


?

Please remember that the survey is anonymous, so please answer honestly!


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Faculty Mobile TEL Prototype Evaluation

After having seen the presentation of the Mobile TEL conceptual model please answer the following questions.

*

Please evaluate the Mobile TEL functionality for agregation of update notifications from a variety of sources (i.e. Blackboard, Facebook, Viber or Other Messaging service) all in one place.

Choose one of the following answers

☐ Excellent
☐ Very Good
☐ Good
☐ Indifferent
☐ Bad (it complicates things)
☐ Other:

? Allows instructors to be available to students through multiple channels of current communications services without having to actively use these services for other reasons, without having to enter in any of the connected applications to see if there is updated content related to their students. It is supposed to make communication between faculty and students faster, more accurate and more timely by keeping all members of the learning community promptly updated about changes in learning content, deadlines, assessment posting, announcements, discussions, and other learning activities. Ideally, it achieves increase in the use of eLearning activities and increase the interactivity between the members of the course community including the instructor making learning more interesting and effective.
It also allows instructors to communicate faster eLearning content and activities to students.

* **Will Mobile TEL Voice Command System assist in enhancing the following areas?**

	Yes	Uncertain	No
Being able to interact with the application only by speech may assist in working with it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Yes	Uncertain	No
in parallel with other activities			
Visually challenged people may have fast access in updating eLearning content and communicating with students that otherwise would be difficult, time consuming or even impossible at such level of integration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*** How would you evaluate the Mobile TEL interface based on the demo screens you have seen at the presentation (screenshots are also available below)? Choose one of the following answers**

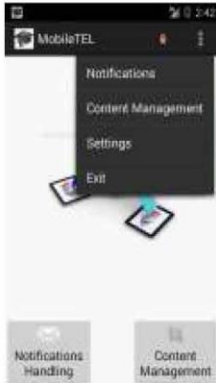

☐ Very easy to use similar to many other Apps.

☐ Generally easy to use with some few confusing areas.

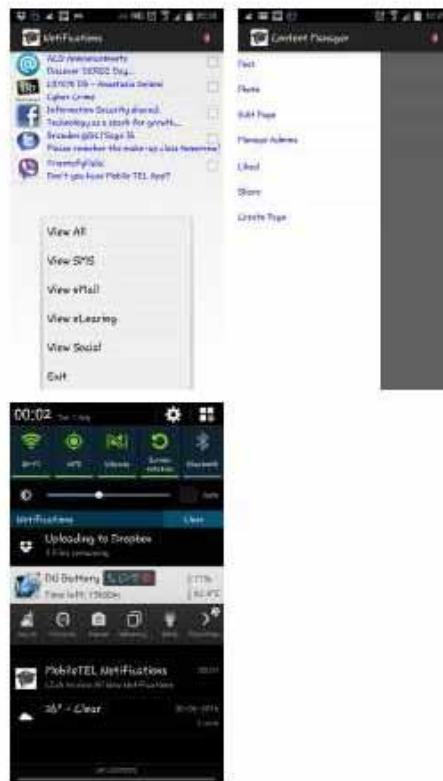
☐ Mostly difficult to use.

☐ Other:

? Since most actions triggered by Mobile TEL are invoking existing installed mobile apps (like Blackboard mobile, Facebook, Viber, etc.) Mobile TEL has a very basic minimal interface shown in the images below.

Mobile TEL Conceptual Application Evaluation Survey

<http://eproject.gr/linesurvey/index.php/survey/index/action/previewgr...>

A survey on eLearning web applications like Blackboard indicated that a quite large number of instructors does not use them effectively but mainly as course documents' repository. Reasons may include lack of time, lack of technical expertise which may result to receiving outdated communication that results into demotivating students to optimally use eLearning web Applications.

Please evaluate if the Mobile TEL will have a positive influence to the above challenges of web based eLearning applications.

	Yes	Uncertain	No
Mobile TEL best utilizes time so Instructors may do more in less time and sometimes in parallel with other obligations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3 of 6

12/7/2015 6:11 μμ

	Yes	Uncertain	No
Mobile TEL is very easy to use so it reduces technical expertise required to manage eLearning apps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile TEL will maximize the communication potential between instructors students and eLearning apps activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

? * eLearning web applications examples may include Blackboard, Moodle, SharePoint LMS Sites, etc.

Mobile TEL permits transferring content from the mobile device in which it is installed to any more appropriate device in the premises like a smart TV or Projector. How would you rate this feature?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

? 1: Poor - 2: Fair - 3: Neutral - 4: Good - 5: Excellent

The fact that eLearning users using Mobile TEL through their mobile devices to stay updated of changes in eLearning content and activities is a major improvement for Technology Enhanced Learning. Do you agree with the above statement?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

? 1: Strongly Agree - 2: Agree - 3: Undecided / Neutral - 4: Disagree - 5: Strongly Disagree

Additionally, the fact that eLearning users using Mobile TEL through their mobile devices are able to directly update and interact with eLearning activities without entering the institutional eLearning platform (i.e. Blackboard), is a major improvement for Technology Enhanced Learning. Do you agree with the above statement?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

? 1:Strongly Agree – 2:Agree – 3:Undecided / Neutral – 4:Disagree – 5:Strongly Disagree

* **The fact that Mobile TEL uses existing installed mobile apps makes it a very light application that does not burden your mobile device. How would you rate Mobile TEL based on this feature?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

? 1:Poor – 2:Fair – 3:Neutral – 4:Good – 5:Excellent

* **Do you think that students but also instructors will be assisted not to loose any eLearning updates if they use Mobile TEL?**

Choose one of the following answers

- ☐ Yes
☐ No
☐ Uncertain

* **Do you think that Mobile TEL Voice command system will assist visually challenged people?**

Choose one of the following answers

- ☐ Yes
☐ No
☐ Uncertain

* **Do you beleive that Mobile TEL will assist in increasing the engagement of Students to eLearning?**

Choose one of the following answers

- ☐ Yes
☐ No
☐ Uncertain

* **Overall how would you rate the Mobile TEL application in terms of assisting in the increase of course interactivity between Students, Instructors and eLearning applications used by your organization.**

Choose one of the following answers

- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Please enter your comment here:

? Please, in your evaluation, consider everything including ease of use, time reduction benefit, updatedness, ubiquity of learning and TEL, increase in interactivity with eLearning content and activities, and disabilities.

Mobile TEL Conceptual Application Evaluation Survey

<http://eproject.gr/limesurvey/index.php/survey/index/action/previewgr...>

1:Poor - 2:Fair - 3:Neutral - 4:Good - 5:Excellent

Mobile TEL Conceptual Application Evaluation Survey

<http://project.graine.survey/index.php/survey/index/action/previewgr...>

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End of Survey

Thank you for participating to this survey!

Please add any comments.

Appendix V – Publications

All surveys have received approvals by the corresponding offices of both Plymouth University and Deree – The American College of Greece.

LEARNING MANAGEMENT SYSTEMS IN HIGHER EDUCATION: A STUDENT PERSPECTIVE

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Abstract

The Internet and especially the Web have effectively become the default mechanism for information dissemination, collaboration, communication and storage. Higher Education institutions have started to make use of these technologies by implementing web based Learning Management Systems (LMS). Their goal is to take advantage of the benefit that web based LMS applications provide by offering their students with a variety of alternative, non-traditional learning methods that may assist the effectiveness of their learning. The paper investigates the effectiveness of implemented LMS applications towards usage of such technologies and subsequently towards learning outcomes from the perspective of students. Data from a university environment was used in order to examine students' usage and evaluation of LMS contents but also to understand from their perspective the state of staff LMS awareness in terms of satisfying their students' expectations. Whilst narrow-focused in terms of respondents, the ability to compare and contrast opinions with actuality provides an interesting insight. eLearning has become a significant method to deliver course materials, while at the same time it is expected to assist students towards reaching the expected learning outcomes, it is important for the academic sector to measure the productivity of LMS implementations from the perspective of their students in order to adopt them in their curricula appropriately. The research provides evidence which recommends that installing a web based LMS followed up by basic technical faculty training will lead in creating module contents that may enhance traditional methods of disseminating course materials offering a more convenient way for students to access it. However, this action alone, will not offer any significant advantage towards the learning objectives of Higher Education, suggesting that a more complete learning strategy needs to be researched to fully utilize the potential of current learning applications.

Keywords: Awareness, eLearning, Higher Education, Internet, Learning Management Systems, Web

1 INTRODUCTION

Learning Management Systems (LMS) combine the functionality of computer-mediated communications, web and general on-line methods to deliver course materials [1]. Many surveys have stressed the strengths of LMS's with the most commonly reported usage as a course materials repository. According to Allen and Seaman [2], 74% of the public Institutions in US, 51% private for-profit and 50% private non-profit institutions support that online learning is a serious long-term factor of their institutional strategy. At the same time, colleges that are trying to reduce their costs while aiming to offer alternative options to their students have started to implement this form of teaching [3]. However, research in modern learning methodologies, proves that providing a modern way for students to access to course materials is far from what students require to achieve the expected learning outcomes. The main reason for this is that the traditional delivery of classes has been designed to service the needs of the industrial revolution era [4]. Just using LMS's as knowledge repositories may enhance the delivery of course related materials, but utilising LMS's merely as a knowledge repository does not necessarily lead to adding value to the productivity of achieving the learning outcomes. Since the design of traditional delivery approaches such as lectures, new learning models have been developed that have only recently started to be implemented in the classrooms of higher education institutions. Their core characteristic is to make the student actively engage in the creation of knowledge rather than being its passive recipient [5]. Following the new educational trends of learning models, web based LMSs such as Blackboard have started to offer features that are in line with the modern learning requirements. However, these features are not so obvious for inclusion by

the faculty staff since they require more expertise both in terms of the technological and pedagogical aspects. In this paper, the students' perspective towards LMS implemented modules in a university environment is investigated to identify particular weaknesses in implementing both traditional and contemporary LMS methods. The aim is to assist higher education institutions in taking corrective actions towards the proper use and development of LMS content and activities in order to develop an appropriate learning strategy that will succeed in enabling their students to reach the expected learning outcomes as set by module syllabi.

The paper begins by presenting the background literature related to learning and its implementation in current technologies. Section 3 describes the methodology utilised to determine the effectiveness of LMS as a learning tool, with section 4 presenting the results. The conclusions are presented in Section 5.

2 BACKGROUND LITERATURE

2.1 From Learning to eLearning

According to Bourner [6], lectures are not only the most common teaching method in higher education, but are being delivered in increasingly larger groups of students. Nevertheless, in their report "How People Learn: Brain, Mind, Experience, and School", the Committee on Developments in the Science of Learning of the National Research Council in United States [7], clearly states that students in class will learn more of what is actually required by the market if their class environments are made very similar to the actual working environments. These two different models to learning are identified as the positivism and constructivism models. The positivism models has dominated universities for several centuries relying on the logic that the instructor's role is to transmit the course knowledge to their students through lectures [8]. The alternative option of constructivism holds that the actual knowledge attained by students relies on their own reality which builds upon their experiences. So if a student memorizes a lectured course material they may score high in an exam but the knowledge related to the memorized material can only be temporarily recalled and will not have actually be learned [8]. Prince and Felder (2006) continue to state that attempting to rationalize to students the reasons for which they need the knowledge related to their courses will not be an effective motive for them to study and absorb it. They alternatively suggest inductive teaching. This method proposes that students are exposed to a problem or scenario (like a case study or a real-world simulation) and through their observations and interpretation of provided data they actually construct themselves, under the guidance of their teachers, the rules, procedures and principles that are traditionally taught through lectures. In 1956, Bloom along with a group of educational psychologists went through research to classify different levels of understanding that students may achieve in a course. These are knowledge, understanding, application, analysis, synthesis and evaluation [9]. It is only logical to assume that in order to reach the higher levels of perceived knowledge, analysis, synthesis and evaluation we need to need to have received learning as dramatized, contrived and direct purposeful experiences [10].

Throughout the ages, several tools were used to assist in learning. However, as Jonassen (2007) observes few of them were originally built to assist towards this aim. The expansion of information technology has also contributed with several tools for learning. The first ones were mostly developed to assist the designers of instruction rather than considering the needs of learners [12]. Nevertheless, cognitive tools which are generalizable computer tools that are intended to engage and facilitate cognitive processing [13] have been introduced. These learning applications have been designed to facilitate critical thinking and collaboration between learners and instructors that are working in groups to facilitate collaborative knowledge construction environments. [5]. The question is, can modern tools be utilized in such a way so they may assist in the creation and delivery of inductively taught courses?

3 METHODOLOGY

This survey studies which areas, features and tools of an LMS students use more, what is the level of satisfaction towards them and finally examine their point of view towards LMS and how they are used by their instructors'. The goal is to identify what areas of LMS are implemented and based on the students perspective detect weaknesses in either LMS applications or the use of LMS by faculty.

The survey was delivered to a sample size of 152 students who have registered in various undergraduate courses from various programs at Deree – The American College of Greece. The

Deree is a non-profit English speaking higher education institution in Greece that offers baccalaureate degrees in the liberal arts and in business administration accredited by the New England Association of Schools and Colleges, USA and validated to offer Honours awards by the Open University, UK.

The survey was delivered to students from a variety of different courses and course levels to capture their opinion as their academic life evolves in all fields of study.

4 SURVEY FINDINGS

4.1 Demographics

Although not intentional the participants of the survey were almost equally distributed between males (45%) and Females (54%). The largest population of students is around the age of 22. Based on Figure 1, when accounting for age, it seems that there is no significant difference in using a variety of LMS features. A large percentage of both younger students and more mature students seem to have experienced little or no exposure to the LMS features while at the same time those students that have used and positively evaluated the features are almost same in numbers.

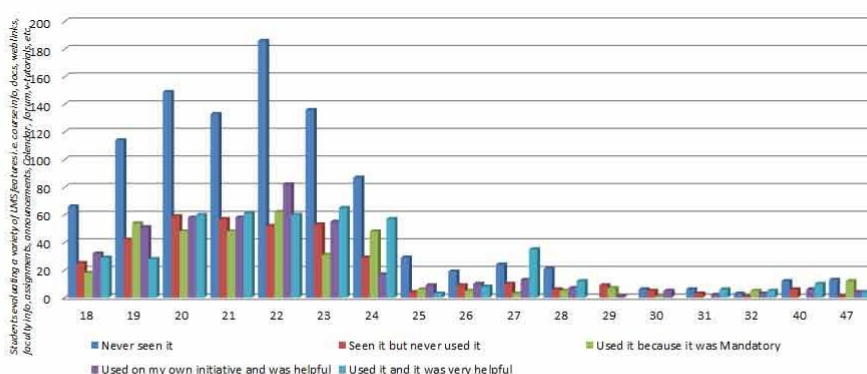


Figure 1 Age vs. Students Evaluation on various LMS features

Most of the participants come from Greek public schools (56%) while there is a significant population originating from Greek private schools (37%). Although Deree is marketed as an international institution, for the time being, a very small population of participants actually originates from educational institutions abroad (7%).

Students are distributed per pathway of studies as exhibited in table 1. For clarification purposes it should be stated that among the 152 surveyed students some are following two pathways simultaneously.

Table 1: Distribution of Students per Pathway

Accounting	7	Liberal Studies	2
History of Art	1	Philosophy	2
Computer Information Systems	12	Psychology	15
Communications	27	Management	25
Economics	6	Marketing	13
English	10	Music	3
Environmental Science	10	Sociology	2
Finance	14	Theatre Arts	2
History	2	International Business & European Affairs	8
Hospitality Management	5	Undecided (1 st year students mostly)	1
Information Technology	9		

4.2 Internet Access Statistics

The distribution of students' access to the Internet is exhibited by the chart in Figure 2. Further analysis indicates that 93% of the students have access to the internet from their homes.

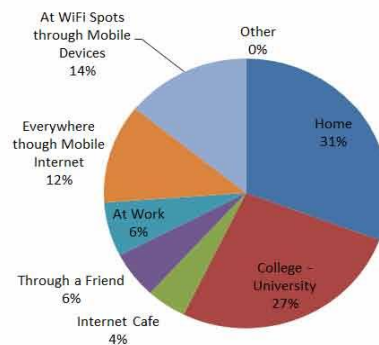


Figure 2 Internet Access

Correlating this with students originating from public vs. private schools, it seems that Internet access is not related to the financial status of the student. It can therefore be surmised that students today do have Internet access from their home, irrelevantly to their financial status. Moreover, 77% of the surveyed students have high-speed Internet access with a significant number of students (18%) have mobile access.

The obvious conclusion from the above observations is that the technology required on behalf of the students to access and use eLearning Systems is adequate and constitutes no barrier to eLearning productivity.

4.3 eLearning Data Analysis

All students participating in the survey have used some kind of website at school, to mostly access institutional information and frequently download material made available to them by their teachers. As illustrated in **Error! Reference source not found.**, a third (31%) of the total population have experienced an LMS system while the number of students that had no access to Internet resources through their school is insignificant.

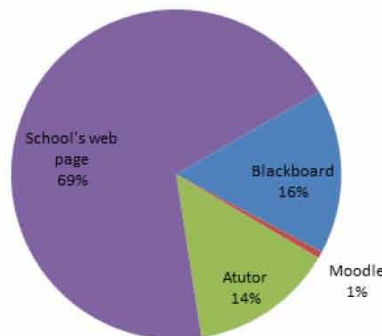
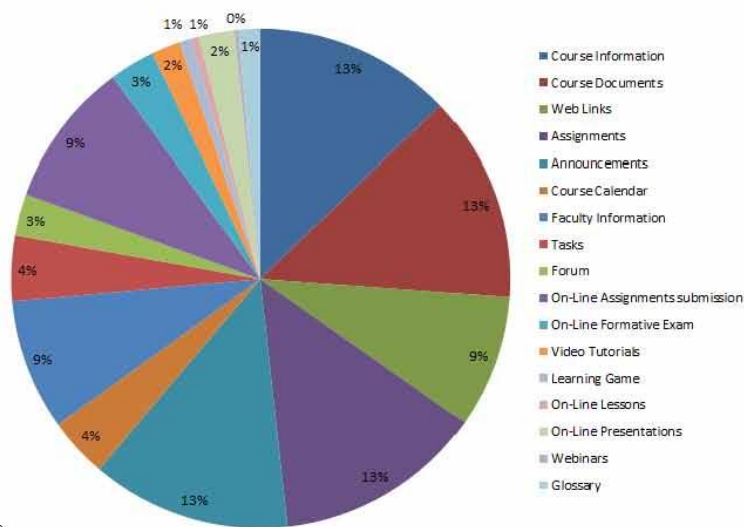


Figure 3 School eLearning Experience

So this empowers the previous evidence concerning whether students are technically experienced to embrace eLearning Systems, since there is a significant number of students that is already familiar to the web, while many of them have experienced some sort of LMS.



According to

Figure 4, it seems that most students are using contents that are directly or indirectly mandatory for them in order to function in the course. Course Information, which is one of the most popular areas students visit, provides documents and information that are related to the course, yet not related to actual learning. Similarly, course Outline is at the top (97%) followed by Absence Policy (80%) and Evaluation Methods (76%).

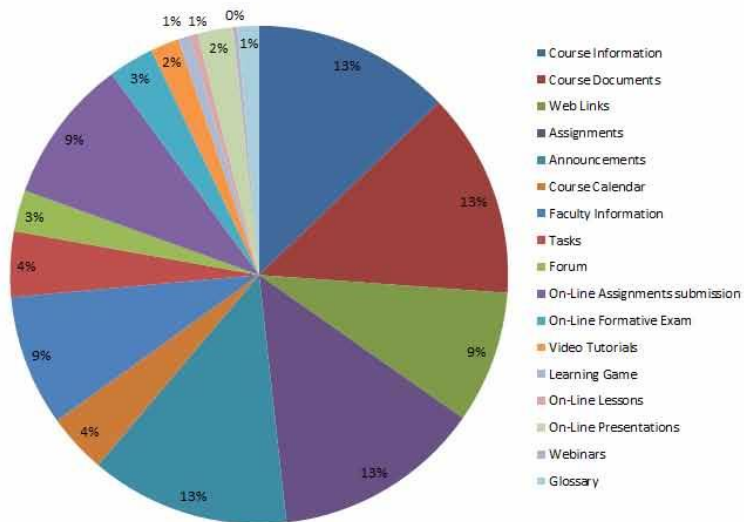


Figure 4 Usage of LMS Functionality

The Course Documents area is also one of the most popular areas of LMS with top accessed documents being Instructor's Notes (77%) followed by Course Presentation Files (70%). This area which provides access to learning related documents is popular, yet not as popular as the Course Information area that disseminates information about the course bureaucracy. However, Web Links posted to guide students to sources of information related to the learning content of their course (especially in business and specifically in CIS and IT courses) are far more popular (76%) compared to those leading to institutional on-line services (41%). Could this be evidence that students prefer to access information related to how things actually work rather than scripts describing how things are supposed to work? For example, in an e-Commerce course, would students be more willing to access a link to an actual live site area that depicts the taught concept (i.e. Amazon check-out process), rather than accessing a link to a site or document that talks about how the concept should be implemented? If so, since both are required to understand the taught concepts, how can we lead students to equally appreciate and receive the required information?

Evidently, not so many of them use the constructivist features of the LMS. However, it remains to be verified that such contents are built and made available by a significant number of instructors to a significant amount of students. Students were asked to provide information about the freshness (or how frequently the site was updated) and the quality of a mix of eLearning features. Illustrated in Figure 5 is a chart depicting how regularly various key aspects of the LMS are updated.

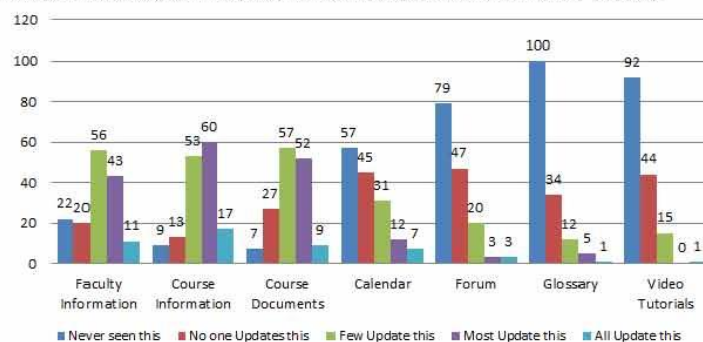


Figure 5: Students' Opinion about content areas updates

It can clearly be observed that the most complex (i.e. Video Tutorials) or time consuming (Glossary) or frequently updated feature (Calendar & Forum) are not even implemented by most instructors or at least if they are implemented they are not promoted or used in their classes. Consequently most students don't even know they exist! Non-complex or fast in implementation modules, that do not need frequent updating, are more extensively used by instructors but also their students. Still, a significant amount of students believe that even those are not updated as frequently as they should.

Investigating further, Figure 6, reveals some interesting evidence about what students think about various features of an LMS.

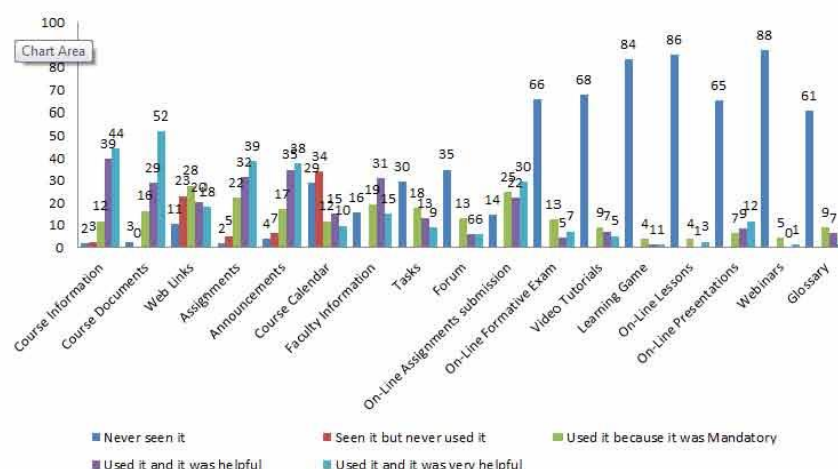


Figure 6: Students' evaluation of various LMS features

Features that support information dissemination, decrease bureaucracy and are relatively easy for instructors to use are quite popular for both staff to implement and for students to use; with the percentage of students that have never seen them insignificant. Furthermore, attention needs to be given to Assignments, which is mostly related to learning rather than the operational support of the course and may provide grounds for instructor – student interaction, is highly appreciated by students (71%). It is evident from those findings that the features that students have never experienced fall into the category of complex (technically or otherwise) to implement or use. That may mean the following:

1. Instructors do not have the technical expertise to use these features. Discussing with colleagues, it was found that many of them, don't even know what features like On-Line Lessons, Webinars, Video Tutorials, Learning Games, etc. are. Few of them that have been acquainted with such features can't really imagine how they can introduce them to their courses. In fact, for some of these tools, such as Webinars and Video tutorials, it would be unfair to expect that instructors from most disciplines (non-technical related disciplines) would have the expertise to use them without training. If an institution wishes to deploy such technologies they should definitely consider that technical specialists should be involved in order to assist faculty towards that direction. Furthermore, such tools require additional specialized software (for example video editing applications, SCORM editors, etc.) that is not made available by the surveyed institution.
2. Instructors do not have enough time to invest in understanding the use of eLearning applications, both to learn develop learning modules. To develop a video-tutorial, not only specialized software is required but also a huge amount of time needs to be invested.
3. There is a problem with eLearning applications and a lack of institutional priority to get it fixed. Information Technology Services personnel of educational institutions are not so different than those found in the other industries. In time they gain experience concerning the particularities of applications used in education, but especially in small institutions, there is one IT department responsible both for educational and operational applications such as LMS, applications required for particular courses and at the same time registration, accounting, payroll, etc. In fact, it seems that most of their time is invested to the operational part of their duties rather than the educational. Hence, they treat the implementation of educational solutions as merely installations of just another piece of software that was requested by the school. They know how to basically install the application, they strive to maintain it, but in most cases they don't know why and how it is used. During this survey, several technical issues occurred by just implementing some representative features of eLearning applications that have been installed sometime in the past, but never were tested or used by anyone. Once they were put into operation, several problems have appeared, some of which have not been resolved for the last 9 months even though technical tickets that were submitted at the support services of the application providers!

Concerning those, not so "popular" features of eLearning applications, which include some of the top constructivist eLearning technologies, some further analysis revealed the following evidence:

- 38% of the total students thought that video tutorials were helpful, while
- 58% of the total surveyed students thought that On-Line Presentations were helpful or very helpful.

So we can draw the conclusion that although not widely available, eLearning features and especially the constructivist ones are gaining significant appreciation by students. However, the data cannot support a trend since most eLearning constructivist features were never made available to the surveyed students:

- 66% of the students have never been asked to use an On-Line Formative Midterm Exam,
- 84% have never been presented with any Learning Game,
- 85% never experienced an On-Line Lesson and
- 87% have never been offered the chance to attend an interactive webinar.

It is impressive to realize that 35% of the total surveyed students have never seen any Technology Enhanced Learning (TEL) application in operation across all programs (as illustrated in Figure 7).

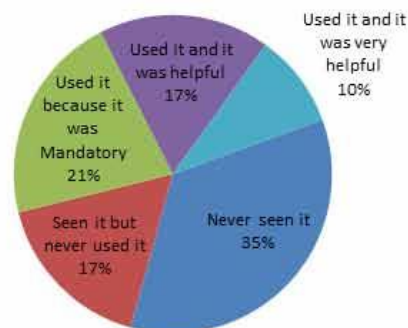


Figure 7: Average of students' observation about which area mostly uses TEL applications

Since it is known that such applications have been significantly used what may be the reasons that such a large percentage of students have never seen them?

1. Students do not have sufficient training in using such tools. It can be seen that those students who would expect to have a better appreciation for LMS and technology, such as the Computer Information Systems program (CIS) do have a lower number of students who have not experienced LMS features that programmes such as Business and the Arts and Humanities. Arguably, both the teachers and the students are more technically competent.
2. TEL applications were not promoted properly or not promoted at all. Just an email announcement of the availability of these resources will reach a very small group of students and an even smaller group will respond to it.
3. There might not be a clear core institutional strategy for eLearning. Especially in Greece, eLearning is a recent unexplored area. Very few institutions have a central eLearning Strategy empowered with people from IT, educational, and faculty members to design, train and develop eLearning applications.

Establishing an overall picture of the use of TEL in practice, it can be seen from Figure 8 that a good proportion (45%) of students have stated that they have not used any content at all. It can be surmised that merely implementing TEL applications and populating them with content does not necessarily mean that students will be attracted to use them at the same time.

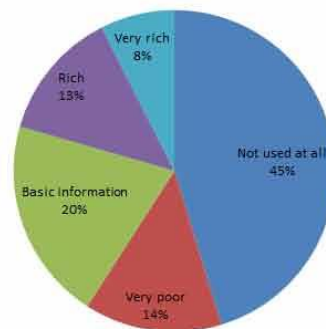


Figure 8: Overall Evaluation of the content use of TEL in various modules

5 CONCLUSION

Buying and installing eLearning technologies by itself will not deliver the expected objectives in relationship to students' productivity towards learning outcomes. The survey has highlighted the following issues:

1. The Institutional eLearning Strategy should become clearer. The evaluation of currently implemented technologies, the design of strategic procedures towards the institutional use of eLearning applications and training of faculty should be empowered by a group of people with background in both technology and education. As Lytras (2001) clearly states, eLearning may only be successful if it is believed as a value adding process that challenges the way of teaching. Otherwise it may be just a waste of time. So in order to have our expectations succeeded, we need to consider eLearning among the top envisioned strategic considerations of the institution.
2. Faculty needs multidimensional training. They don't just need to learn how the particular features work but also what are they useful for and how they map to learning strategies. Simple technical training has been considered boring and a waste of time. Interactive sessions based upon the institutions own LMS would provide informed knowledge of the usefulness of applications and training in how to use them. Training should be among the key Institutional eLearning Strategy goals.
3. Training sessions for students on what TEL options are available and how they are used. It is logical to expect that students may completely ignore what they do not know. Currently a small presentation of the institutional LMS is included to the laboratory sessions supplementing the CS1070 course, which might be another reason of the high appreciation that students of this course have towards these applications. However, this training is not standardised and instructors that, rightfully or not, do not implement most of the LMS features also deliver it.
4. It is obvious that eLearning cannot succeed institutionally without the active and very demanding involvement of the faculty. For that to be successful and provide long-term benefits, consideration needs to be made on the particularities of the task. This cannot be considered as just another small extra job for the faculty to be involved into. Mental concentration, creativity, experimentation and research are required to be qualitatively productive. Time needs to be made in the already overwhelmed faculty schedule. Whilst voluntary work is great and generally much appreciated it is not enough for a serious strategic project.
5. Some of the most productive eLearning features cannot fit in the current evaluation system. Several of those were presented as part of the formative assessment of the course but they failed to reach a large number of the students if not part of a summative assessment (or associated with a particular incentive). It has been established in previous sections of this report that students do not react upon the rational of what these contents will offer in their progress or future. At the same time, in courses where a more serious effort towards eLearning features was attempted, we do have evidence that students exhibited interest for and embraced these technologies.

eLearning applications definitely have a future that cannot be overseen. In fact, if not careful, it may become a disruptive technology in the sector. However, it is not as simple as it may appear to be at a first glance. It is complicated, not only because of the technology involved but also because of its

purpose and target group. Education is one of the fundamental pillars of every civilized society and is neither simple nor obvious. The target group, students, are the most complex, diverse and at the same time sensitive group in our society. TEL applications may be used as an aid to traditional teaching, complimentary to education or even a new channel of education itself. Considering the evidence provided by this survey, success and long term deliverables seem to only be possible if eLearning is treated as a strategic project with all the effort, time and financing that needs to be invested.

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LEARNING MANAGEMENT SYSTEMS IN HIGHER EDUCATION: A FACULTY PERSPECTIVE

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Abstract

The use of the Internet and the Web have gradually made their way into the methods that students, lecturers and generally the education community communicates, stores, shares and collaborates. Indeed, it has arguably become the norm rather than the alternative. As an alternative to traditional learning techniques, web-based Learning Management Systems (LMS) are being offered to students in order to assist and improve their learning experience. This paper analyses how the implementation of an LMS affects the learning outcomes from the viewpoint of the higher education staff. In order to understand the faculty awareness of LMS systems, data from university environments were collected to provide an opportunity to compare and contrast opinions. It is important for the academic sector to understand and measure productivity achieved through the implementations of an LMS from the perspective of the staff so that they can adopt them in their curricula appropriately. Based upon the evidence provided from the research, it is recommended that basic faculty training implemented after installing a web based LMS may help create module contents that could improve upon the traditional methods of disseminating course materials in a more accessible way by students. However, basic training by itself will not offer any significant advantage towards the learning objectives of Higher Education, suggesting that more specialized continuous training is required. Furthermore, a complete learning strategy needs to be researched to fully utilize the potential of current learning applications and keep faculty updated to the continuous introduction of new technologies in the sector.

Keywords: Awareness, eLearning, Higher Education, Internet, Learning Management Systems, Web

1 INTRODUCTION

The functionality of computer-mediated communications, web and general on-line methods to deliver course materials is combined in Learning Management Systems (LMS) [1]. The strengths of LMS's have been highlighted in many surveys, and the most common usage reported has been their use as a course materials repository. According to Allen and Seaman [2], 74% of the public Institutions in US, 51% private for-profit and 50% private non-profit institutions support that online learning is a serious long-term factor of their institutional strategy. At the same time, colleges that are trying to reduce their costs while aiming to offer alternative options to their students have started to implement this form of teaching [3]. However, providing a modern way for students to access course materials is not necessarily what students require in order to achieve the expected learning outcomes. One of the main reasons for this is that the traditional delivery of classes has been designed to service the needs of the industrial revolution era [4]. Therefore, using LMS's simply as a knowledge repository does not necessarily lead into adding value to achieve the learning outcomes; however, it may enhance the delivery of such materials as demanded in the modern world. The core characteristic of new learning models that have been recently developed are mainly to engage the student in an active way, compared to the traditional approaches of classroom lecture deliveries in higher education [6]. Even though web based LMSs, such as Blackboard or Moodle, have started to offer features that are in line with the modern learning requirements, in order to follow the new educational trends of learning, these features may prove challenging to be utilised by faculty that will need to sharpen their expertise both in terms of the technological and pedagogical aspect.

To identify particular weaknesses of implementing both traditional and contemporary LMS methods this paper will investigate the implementation of LMSs from the perspective of faculty in higher education. The aim is to assist higher education institutions in taking corrective actions towards the proper use and development of LMS content and activities in order to develop an appropriate learning strategy that will succeed in enabling their students to reach the expected learning outcomes as set by module syllabi.

The paper begins by presenting the background literature related to learning and its implementation in current technologies. Section 3 describes the methodology utilised to determine the effectiveness of LMS as a learning tool, with section 4 presenting the results. The conclusions are presented in Section 5.

2 BACKGROUND LITERATURE

2.1 From Learning to eLearning

According to Bourner [5], although lectures are not only the most common teaching method in higher education, they are being delivered in increasingly larger groups of students. Nevertheless, the Committee on Developments in the Science of Learning of the National Research Council in United States [6], in their report "How People Learn: Brain, Mind, Experience, and School", clearly states that students in class will learn more of what is actually required by the market, if their class environments are made very similar to the actual working environments. There are two identified models for learning. The positivism model relies on the idea that the instructor's role is to transmit the course knowledge to their students through lectures [7] and it has dominated universities for several centuries. The constructivism model supports that students will achieve actual knowledge when it is based and built upon their own experiences. So if a student memorizes a lectured course material they may score high in an exam but the knowledge related to the memorized material can only be temporarily recalled and will not have actually be learned [7]. Prince and Felder (2006) continue to state that attempting to rationalize to students the reasons for which they need the knowledge related to their courses will not be an effective motive for them to study and absorb it. The alternative method is referred to as inductive teaching, where students are immersed into a simulated real-life problem or scenario and through the guidance of lecturers are taught the various rules, procedures and principles. In 1956, research showed that different levels of understanding that students may achieve in a course were classified as knowledge, understanding, application, analysis, synthesis and evaluation by Bloom and a group of educational psychologists [8]. It is only logical to assume that in order to reach the higher levels of perceived knowledge, analysis, synthesis and evaluation we need to have received learning as dramatized, contrived and direct purposeful experiences [9].

Throughout the ages, several tools were used to assist in learning. However, as Jonassen [12] observes few of them were originally built to assist towards this aim. Even though the expansion of information technology has contributed with several tools for learning, the first ones were mostly developed to assist the lecturers rather than the learners. However, cognitive tools that are intended to engage and facilitate cognitive processing have been introduced and were designed to facilitate critical thinking and collaboration between learners and lecturers that are working in groups to facilitate collaborative knowledge construction environments [11].

In 2012, a survey on students of higher education [12] revealed that there are several challenges in implementing inductive teaching through LMS applications. However, it seems that these challenges are not related to technological inabilities but mostly difficulties in understanding and properly implementing the available technology. In this faculty survey, these weaknesses are identified to assist in amending the implementation of LMS content and activities in a way so they may assist in the creation and delivery of inductively taught courses.

3 METHODOLOGY

The survey studies which features and tools of an LMS are mostly used by faculty and the environment within which the faculty develops these applications. Additionally, staffs are asked to evaluate their experience and training with respect to pedagogical and technical expertise required for developing inductive LMS. Finally, they are inquired to evaluate the student perspectives of LMS and the institutional strategy implemented in their organization.

The survey was delivered to a sample size of 100 faculty members (largely from Greece, but also from UK) from a variety of disciplines and higher education institutions which offer graduate and postgraduate courses in various programs including liberal arts, business administration, communications, and sciences.

4 SURVEY FINDINGS

4.1 Demographics

The participating staff in this survey were fairly evenly distributed with a 54/46% split between female and male populations. The largest population of staff belong to the 45-54 age group, while the second largest group is that of 35-44. Examining if there is a relationship of preference between the age

group and what faculty members believe LMS use is best for, it was found that faculty in the age groups from 35-54 (70%) strongly believe that LMS is a very good if not the optimum tool to be used as a repository of course materials Figure 1.

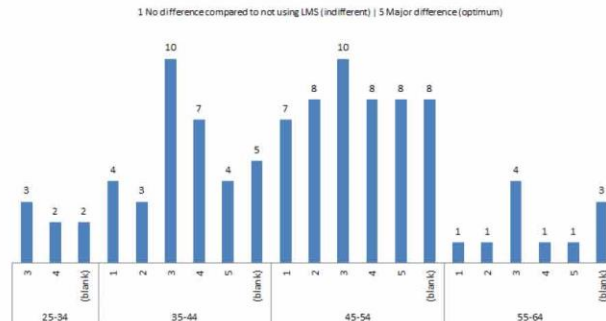


Figure 1 Faculty evaluation of LMS as a repository of materials tool

Most of the participants are staff from the Greek private higher education institutions (72%), while the rest of the faculty comes from Plymouth University and the National University of Greece as shown in **Error! Reference source not found.** If it was considered that the location of staff was not a variable of importance, as the purpose of the study was to focus upon individual staff perspectives and their experience (which may have been gleaned from a variety of previous institutions at which they worked).

The survey was distributed to staff from a large variety of disciplines; however, as the LMS is an Information Technology tool, they were grouped in to disciplines that have an IT background and those that are not, as seen at the following chart in Figure 3.

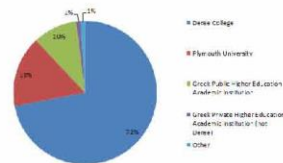


Figure 2: Staff Origin



Figure 3: Staff disciplines based on IT background

4.2 Environment to Develop LMS

LMS and especially the advanced features which assist in developing constructive on-line learning modules obviously relies to: a) high speed access to the Internet due to the size of data to be uploaded, b) availability of software to develop such contents and c) a work environment that enables staff responsible for their development to concentrate and be given the time in order to be productive.

As seen in Figure 4 the survey indicated that the speed of access available to the respondents is adequate for most of the participants:

Only in the case of a relatively small proportion of participants (12%) there may be difficulties. However, when questioned whether staff are stationed at an office that is suitable for creative academic work – which is what the development of constructive LMS modules requires – an impressively large percentage of 44% responded no. The characteristics of what a “suitable” for creative academic work environment were stated as a quiet office shared with very few or no colleagues, while at the same time having access to the hardware and software resources that are

necessary. This suggests that 44% of participants may be unable to cope with the demanding tasks of developing constructive LMS modules.

4.3 LMS Faculty Use Analysis

Based upon the analysis of the surveyed data 24% of the total staff do not use an LMS at all. The remaining 76% of the faculty are using the following platforms as portrayed Figure 5.

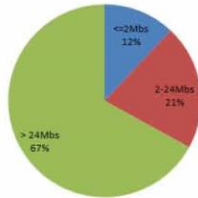


Figure 4: Office Speed of Access

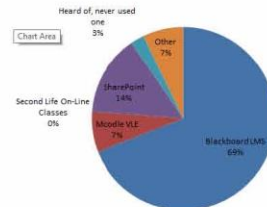


Figure 5: LMS platforms used by faculties

From those LMS platforms, Blackboard [13] and Moodle [14], which correspond to 76% of the platforms used by the respondents, support the creation of advanced constructive learning modules. SharePoint using Tulip that is offered by Plymouth University is basically used as a repository (CMS) system according to the Technology Enhanced Learning of Plymouth University web page [15]. However, staff can actually utilize the constructive learning functions supported by the above platforms.

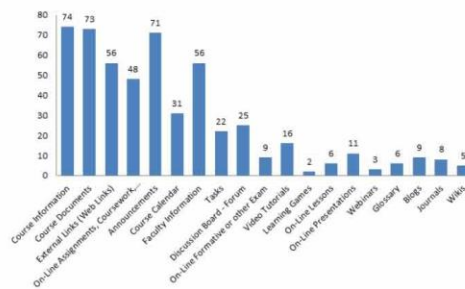


Figure 6: eLearning functions used by faculty

As shown in Figure 6 above, most of the staff use an LMS mainly as a Content Management System (CMS), while very few of them use the tools that may lead to creating a constructive learning environment. The only one of those functions that seems to be somewhat more popular is Forums. Blogs, Journals, Wikis, Learning Games, etc. are not among the preferences for the vast majority of the faculty, which mostly favors Course Information and Documents, Web Links, Announcements and other functions which used for reasons depicted in Figure 7 and Figure 8 below:

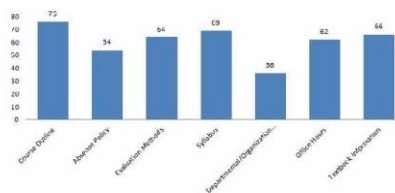


Figure 7: Course information usage

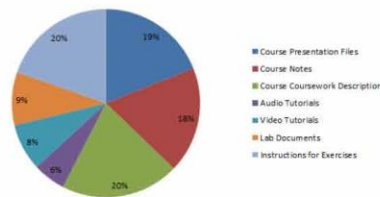


Figure 8: Files offered via LMS

Furthermore, LMS constructive learning functions require in many cases third party software such as Interactive Video Editors to produce Video Tutorials and SCORM Editors [16] to produce interactive lessons. According to the survey only 16% of the total surveyed faculty has ever used such applications.

Summarizing, although most have access to LMS's that support constructive learning functions staff still prefer to use the offered LMS as a repository of information, which in most cases is not related to the learning process but to communicating administrative content and policies related to the module they teach. There are likely many reasons for this:

1. According to Britain and Liber [17], "Education providers using VLEs and other ICT tools for e-learning have two primary aims: to enhance the quality of teaching and learning by allowing teachers to use pedagogies that are not possible with large numbers in a face to face environment and to manage the delivery and administration of programs of learning through an electronic (on-line) medium". To achieve this, both technical and pedagogical awareness is required, so the questions are:
 - a. Does faculty have the technical knowhow required to develop such learning modules?
 - b. Does faculty have the pedagogy background required?
2. Does faculty have enough time to develop such learning modules?
3. Does Faculty have enough contact time with students to enhance lectures with constructive LMS modules?
4. Constructive LMS modules rely upon the following:
 - a. Content that builds with time and not in one academic period, hence relies on the interactions of many past and present students similarly to an expert system.
 - b. As a result of continuous content accumulation, LMS relies to the ability of IT to support big data collections.
 - c. This can only be possible if adequate resources are offered by the implemented LMS technologies.

4.4 Faculty Opinions on Various LMS Aspects

In this section, staff are asked to evaluate various LMS aspects including the training they received, what training they should have received, and their thoughts towards why students do not use the few implemented constructive LMS modules.

4.4.1 Faculty Training

The surveyed faculty was asked if they have received any training relative to the eLearning Course Management System their institution is using. An impressive 32% of the faculty had not received any LMS training at all, most of it originating from UK (Plymouth) and Greek National Public University.

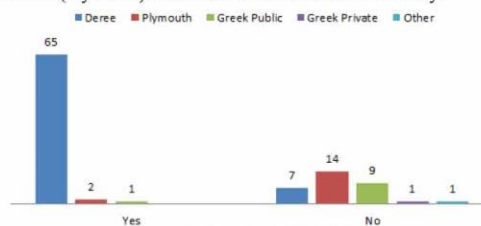


Figure 9: Faculty LMS training

The remaining 68% of the faculty that stated they have received LMS training were asked to evaluate it both in terms of time sufficiency and in terms of content sufficiency. The results are displayed in Figure 10.

Less than half of the responders (47%) believe they have received sufficient training. 24% responded that they have only received technical training on how the application works but no training on how to use this knowledge from a pedagogical point of view, which is a requirement for implementing constructive LMS modules. Finally, 25% of them claimed to have received some basic technical training, yet far from what is required to technically implement the advanced LMS features.

To examine the reasons for the above stated inefficiencies, the surveyed faculty was asked to provide the background characteristics of their trainer, which are displayed in Figure 11: Trainer background characteristics.



Figure 10: LMS Faculty training sufficiency

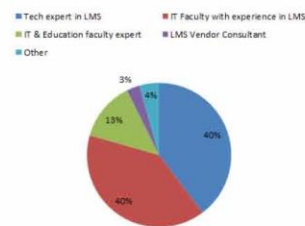


Figure 11: Trainer background characteristics

As illustrated, 80% of the staff responded that the trainer was an IT expert specializing in LMS or a member of IT staff experienced in LMS. In both cases this indicates that the background of the trainer was from IT so it is safe to conclude that the majority of the respondents have mostly received technical and not pedagogical training (which arguably is of equal value). Only 13% of the respondents identified a trainer with the combined characteristics that are expected for the creation of constructive modules and an almost insignificant 3% were trained by a vendor consultant (like a Blackboard representative) who might have included in their training some examples of constructive implementations.

At this point, staff were asked to state their opinion by evaluating their training needs in the following areas: a) General training in IT with focus on LMS b) Specific LMS Training c) Pedagogy and Education Training d) IT, Pedagogy and Education Training

The findings are illustrated in Figure 12. A further analysis of these results gives rise to the following observations:

- 31% of staff believe they need more sufficient or expert general IT training focused upon LMS. This is justifiable considering that the majority of the staff originates from disciplines that do not provide in-depth IT background as shown in Figure 3. At the same time however, 50% of the faculty believes they have adequate technical awareness with respect to the requirements of LMS applications.
- Expert trainers with respect to LMS are required according to 34% of the respondents, while 50% of them do think they need little or no training.
- 38% of the respondents believe they need more sufficient or expert training in pedagogy and education in order to implement LMS solutions – with that being more important than IT training since most of that faculty consider that their IT awareness is adequate for LMS applications.
- Surprisingly, 50% of staff believe that they only need some or no training at all with respect to pedagogy and education although their background for most of them is not related pedagogical disciplines. Arguably, only when required to develop a constructive LMS module one may realize their weaknesses in terms of the pedagogical awareness required.
- Finally, 40% of the respondents think they need more sufficient or expert training in both IT and pedagogy concepts with respect to LMS applications.

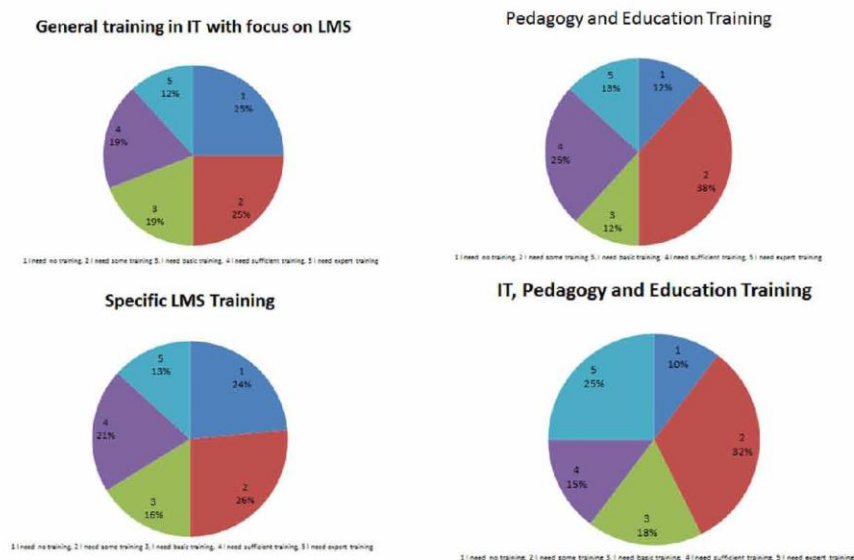


Figure 12: Faculty opinions about LMS training Needs

At this point we need to observe that the responses recorded in Figure 12 are based upon those staff who responded that they had undertaken training offered by their institution. In other words, the key observation here is that almost half of the staff did not consider that training was sufficient to deploy constructive LMS modules both in terms of IT and in terms of pedagogical and educational needs.

To understand in more depth the awareness of faculty with respect to IT and pedagogical concepts involved in LMS, staff were asked to identify a familiar a set of terms that have direct relationship to LMS. These terms and the faculty responses are recorded in Table 1 below.

Table 1: Faculty familiarity with LMS related terms

	Yes	No	Uncertain
Positivism	41	38	21
Wiki	78	11	11
Video tutorial Authoring Software	34	41	25
Webinar	68	16	16
Constructivism	42	35	23
STAR Legacy	1	85	14
Forum	78	9	13
Learning Blog	51	20	29
Learning Journal	44	23	33
Average	51.1	28.7	20.2

The evidence shows that at average 29% of the faculty is not familiar at all with those terms, while a further 20% are uncertain about the provided terms. Exemptions to these are observed with respect to Wikis (78%), Webinars (68%) and Forums (78%) where staff seem to be largely familiar with them. Of course, the terms correspond to technologies that are very popular in the web; however, arguably in most cases, due to websites that are probably not related to LMS. Yet, although faculty seems to be familiar with those, they are the most demanding ones with respect to both IT and pedagogy background required, in order to develop, implement, administer and monitor. Considering the training

insufficiencies spotted above, it seems very difficult for most members of staff surveyed to properly use such options.

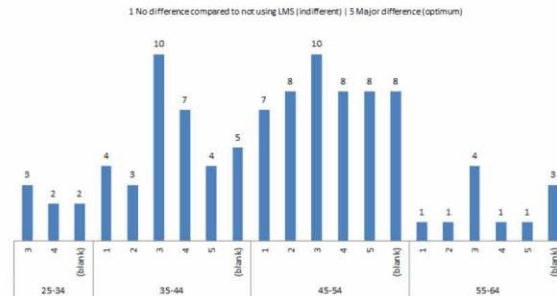


Figure 13: LMS best used for learning objectives per age group

One would expect that the younger faculty age group would mostly favor the use of LMS. However, it seems that older members of staff place more faith in them in all four characteristics including their ability to assist in achieving the course learning objectives as shown in Figure 13 above.

Finally, staff was asked if – due to the implementation or administration of the LMS they use - they have to recreate all content per module and uploaded them to LMS at the beginning of every academic period. 33% of them responded that they have to go through this process. Since many of the constructive functions of LMS, like forums, wikis, learning blogs and journals do rely on data that is accumulated with time, which would be a major technical barrier for implementing such features. Imagine uploading several Mbytes or even Gbytes every semester. This is easy to resolve technically if IT administration responsible for the management of LMS is guided by an eLearning expert to implement the institutional LMS in a way that favors the objective of learning. Otherwise, it is likely staff will merely chose to use the LMS for basic activities.

4.4.2 Faculty evaluates student views of LMS

According to the survey presented in ICERI 2012 [12], 35% of students in higher education who did have access to a LMS in their institution, claimed that have never seen any LMS technologies implemented for their courses due to the fact that their instructors did not implement or promote LMS solutions. The faculty in this survey was asked to offer their opinion about the reasons leading to that fact. The outcome of their response are listed in Table 2:

Table 2: Faculty evaluation of reasons on why students have never seen LMS implementations

Reasons	Very to extremely important
Not enough Faculty Time to develop LMS	41%
Inadequate IT Faculty Training	55%
Inadequate Faculty Pedagogy Knowledge	47%
Not enough Classroom Time	37%
Missing Complementary Apps	34%

All five possible reasons regarding the students' feedback on LMS implementations were considered very important to staff with highest being the insufficient training both in technical knowledge and pedagogy awareness required.

Similarly, based upon the same study observations, staff were asked to evaluate in terms of importance the reasons why 30% of students that have seen LMS implementations in their courses have never been exposed to more advanced eLearning features such as video tutorials, forums, journals, wikis, etc. The faculty evaluation of reasons is presented in Table 3.

Table 3: Faculty evaluation of reasons on why students exposed to LMS have never seen advanced eLearning features

Reasons	Very to extremely important
Not enough time to develop LMS	53%
Not enough IT training	60%
Not enough pedagogy training	54%
Not enough classroom time	42%
Unavailable supplementary apps	49%
Ignorance of LMS advanced features	22%
Features not supported by installed LMS	29%

A very interesting observation on the above evidence is that from the 29% members of staff that responded questioned whether features were supported by the installed LMS. 86.4% of them are working in an institution that does offer to them an LMS that actually supports the above features! It is just that they don't know it or they do not have adequate knowledge to identify it.

4.4.3 eLearning Strategies Department

Concluding, the surveyed staff were asked to report if there are specialized personnel available for the development of eLearning strategies in their institution. The evidence presented in Figure 14: eLearning strategies support department below shows that only 15% of the respondents have identified a department dedicated to eLearning strategies in their organization, while a large 47% reports that the LMS is just another IT application handled by the IT department.

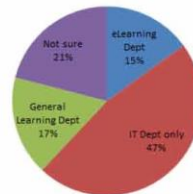


Figure 14: eLearning strategies support department

5 CONCLUSION

LMS software has been established to offer a platform for building eLearning content and activities. Although the implementation of positivism methods seems to be easily achieved, a previous survey examining the students' perspective on LMS [12], and also this current survey on faculty perspectives on implemented LMS, exhibits that achieving inductive LMS applications is distracted by several challenges.

It is clear that a very significant percentage of the faculty responsible for the development of LMS content and activities claims that they do not have sufficient training and support both in terms of technical issues involved and in terms of pedagogical background, specific to the TEL applications required. Additionally the survey exhibits that faculty does not have enough time to invest towards building inductive LMS.

An institutional learning strategy should be empowered by eLearning experts with background both in technology and education. They should be responsible for training but also supporting the faculty both in technology and educational aspects required to develop LMS-based applications in accordance to the institutional learning strategy. Most important, they should be responsible for recommending the institutional eLearning strategy in alignment with the institutional learning strategy. It is evident from the survey that this role cannot be implemented by the traditional IT Departments in higher education institutions.

Developing LMS courses is frequently equal if not bigger in terms of time invested in development and delivery of a traditional course. The target group, students, are the most complex, diverse and at the same time sensitive group in our society [12]. In addition, it requires investment in acquiring the

technology and training required to adequately supplement the LMS platform. Inductive LMS applications require mental concentration, creativity, experimentation and research to be qualitatively productive. eLearning may only be successful if it is believed as a value adding process that challenges the way of teaching – otherwise it may be just a waste of time. So in order to have our expectations succeeded, we arguably need to consider eLearning among the top envisioned strategic considerations of the institution [18].

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INCREASING ELEARNING ENGAGEMENT USING MOBILE TECHNOLOGIES

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Abstract

Web-based Learning Management Systems (LMS) have their way into the methods that students, lecturers and generally the education community communicates, stores, shares and collaborates. Although technically they seem to provide an ideal environment for deploying constructive eLearning activities, yet, research indicates that they seem to fail producing and maintaining a critical mass of engaged learners to such implementations. Eventually, they end up being used as learning related content repositories instead of learning enablers. This paper presents a novel mobile application prototype design that has been positively evaluated by students, instructors and eLearning experts to contribute to learning by drastically increasing the engagement of learners to institutional web-based eLearning platforms. The novelty of the prototype lies in the integration of current popular on-line services (including but not limited to social media, messenger services, SMS, email, etc.) where learners, as research proves, are already engaged. Taking advantage of the unique features of mobile devices and their impressive market penetration, the prototype, achieves in providing the designs for a ubiquitous application that blends a variety of on-line and mobile technologies towards the aim to increase up datedness of learners with respect to eLearning activities. In addition to that, the mobile application, makes eLearning implementations optimally available to directly and easily interact with, without time and geographic restrictions but also without device limitations and extensive device interoperability by transferring content from the mobile to PC, TV, projector etc., directly from within the preferred application used by the learner. Cutting edge technologies in semantics, speech recognition and a user friendly UI are embedded in the prototype design aiming to positively leverage interaction.

Keywords: eLearning, Higher Education, Internet, Learning Management Systems, Web, Mobile Apps, Mobile Devices, TEL.

1 INTRODUCTION

Blended eLearning and other web-based technologies have entered a significant part of Higher Education Institutions [1]. Since 2010 Allen and Seaman research [2], indicated that 74% of the public Institutions in US, 51% private for-profit and 50% private non-profit institutions support that online learning is a serious long-term factor of their institutional strategy. In 2011, Young [3], in his report, observed that there is a clear indication on behalf of College administrations, towards eLearning implementations as part of their cost strategy. At the same time, social media are used by a significant amount of instructors and most students. They all connect with their peers in a way that assists them to be exposed to more communication options leading to develop personal relationships compared to the traditional face-to-face communication [4]. It seems that social media used for educational purposes has a positive even higher effect to the engagement of students to learning activities. DiVall [5], exhibited this by introducing a Facebook page and a Blackboard discussion board to compare the engagement of students to discussion and generally interaction to the corresponding environments. 25% more students posted on Facebook compared to Blackboard confirming the empirical observations made above. The engagements of both students and instructors to social media has led companies like Lookabee to develop a platform that may be used by instructors to create Facebook applications to keep in touch with students [6].

Nevertheless, despite the improvements, investment and efforts towards Technology Enhanced Learning (TEL), the engagement of learners to eLearning activities and especially constructivist activities remain very low [7], [8] for a variety of limitations such as ineffective notification of updates,

lack of time required for building eLearning activities and monitoring them, lack of technical or pedagogical expertise, etc.

At the same time, mobile devices seem to have taken over the market. According to the UK Office for National Statistics [9] the number of people accessing the Internet using a mobile phone reached 53% in 2013, a number which becomes even more impressive, if you compare it to the 24% of 2010. Based on these facts, which do not include other mobile device Internet users (such as laptops), it is evident that mobile Internet access has become mainstream in a very small period of time. Huang but also Botha, state that Mobile Learning (mLearning) has more advantages compared to eLearning platforms [10] and greater potential to enhance educational environments by providing access to information and communication capacities in a personalized and ubiquitous manner [11].

Considering the limitations but also the potential of current technologies, the idea of designing a prototype that will combine the advantages of multiple technologies and make them available in the best possible way through a mobile application was conceived. The prototype (Mobile TEL or mTEL) aims to drastically increase the engagement of learners to web-based eLearning platforms, including the constructive ones. This is achieved by developing an m-learning application that adds value to current web based institutional eLearning platforms by enriching them with the beneficial attributes of mobile platforms such as ubiquity, convenience and interactivity [12]. Furthermore, by using and taking advantage of current popular mobile applications, such as social networks and communication mobile apps, in alignment to m-commerce drivers, the benefit of suggesting the use of technologies with which users are already familiar with is achieved.

2 BACKGROUND LITERATURE

2.1 From Learning to mLearning

Lectures are not only the most common teaching method in higher education but are additionally being delivered in increasingly larger groups of students according to Bourner [13]. This evidence is justified by the fact that large class lectures are highly cost-effective as stated by Mayes [14]. However, students in class will learn more of what is actually required by the market, if their class environments are made very similar to the actual working environments [15]. Based on such observations, two models of learning are identified: The positivism model that supports that the instructor's role is to transmit the course knowledge to their students through lectures [16]. This method has dominated higher education for centuries. On the other hand, the constructivist model suggests that students will achieve actual knowledge when it is based and built upon their own experiences. The argument is that positivism learning mostly relies to memorization. Although a student that has memorized the material may score high in an exam, the knowledge related to the memorized material can only be temporarily recalled and will not have actually be learned [16]. Furthermore, Prince and Felder (2006) observed that rationalizing to students the reasons for which they need the knowledge related to their courses will not be an effective motive for them to study and absorb it. The alternative constructivist method, also referred to as inductive teaching, indicates that students are immersed into a simulated real-life problem or scenario and through the guidance of lecturers are taught the various rules, procedures and principles. A 1956 research showed that different levels of understanding that students may achieve in a course were classified as knowledge, understanding, application, analysis, synthesis and evaluation by Bloom and a group of educational psychologists [17]. Consequently, in order to reach the higher levels of perceived knowledge analysis, synthesis and evaluation, it is logical to assume that we need to have received learning as dramatized, contrived and direct purposeful experiences [18].

Although several tools have been used throughout the ages, as Jonassen [20] observes, few of them were originally built to assist towards this aim. Despite the wide expansion of Information Technology which has contributed with several tools for learning, most of those tools, especially at the beginning were built to assist lecturers rather than learners. Furthermore, most eLearning tools have adopted technologies that were originally designed for other industries and not by members of the learning community [20]. However, cognitive tools that are intended to engage and facilitate cognitive processing have been introduced and were designed to facilitate critical thinking and collaboration between learners and lecturers that are working in groups to facilitate collaborative knowledge construction environments [20].

Surveys on students and instructors of higher education institutes were performed in 2012 and 2013 correspondingly indicating that there are several challenges in implementing inductive teaching

through LMS applications [7], [8]. This was indicated by evidence depicting very low if any at all engagement on behalf of both students and instructors in such eLearning activities. Besides the difficulties on understanding, properly implementing and using the available technology, there seems to be a problem in promptly and effectively communicating updates of the evolving eLearning activities at the right time and place failing to keep learners updated. As a consequence, critical mass that is required for the successful implementation of the activity is lost along with the effectiveness of the tool.

Social networks have become increasingly visible in higher education institutions while recently instructors started to experiment with these technologies aiming to improve their courses [21]. Several services provided by social networking sites were used for education providing specific advantages especially for distance learning [22].

Lytras predicts that "the vast majority of learning in the next 20 years will be offered through flexible open out of the classroom approaches mainly supported by applications and mobile devices as well as wearable technologies." [23]

Higher education institutes like Purdue utilized several current web and mobile technologies to be used inside and outside of the classroom [24]. Technologies used included Facebook, Twitter, SMS, smartphone captured video, cloud services, etc. The purpose was to study the influence of technology to students with focus to smartphones and their applications. The results indicated that 83% of the students own a mobile device, while 43% of them are to be considered advanced users and 42% intermediate. According to the same survey there is clear indication that there is an increasing preference for native mobile apps rather than using the mobile web browser.

Based on the above observations, education stands one more time in the middle of several fast growing technologies that although not designed for education, research shows that each one of them has several advantages to offer with respect to learning. This provides fertile ground for an mLearning application to be developed that will combine current popular web and mobile services benefits to learning through one single mobile application designed specifically for education.

3 APPLICATION OBJECTIVES, REQUIREMENTS, SPECIFICATIONS AND ARCHITECTURAL DESIGN

Based on the two surveys conducted separately on staff and students [3], [4], students seem not to include enough or at all, in their daily habits, the monitoring of eLearning content and activities provided by Higher Education TEL web-based platforms. In addition to that, academic staff, being overwhelmed by their numerous duties but also due to technical background deficiencies that are often required to develop interactive eLearning activities, fail to respond to the level required to achieve student productivity via eLearning applications.

mTEL attempts to approach the problem in an opposite way. Instead of expecting students and staff to come closer to TEL applications, it brings TEL closer to them by creating a mobile interface that will utilize existing modern and popular communication methods through one single application that will be responsible to disseminate content in a synchronized fashion via all communication channels, increasing the probability that all involved parties will receive and will respond to notifications and activities promptly. So the main objectives that have to be met in order to increase engagement of the learning community (staff and students) should be the following:

3.1 mTEL Objectives

- To be able to receive communications and content from a variety of on-line sources, web and mobile at real-time.
- To be able to disseminate communications and content to a variety of on line sources, web and mobile at real-time.
- To be able to share content to a variety of available devices and communication methods (i.e. other computers, smartphones, TVs, projectors, etc. or via Wi-Fi, Bluetooth, NFC, Android Beam, etc.)
- To automatically choose the most appropriate available content format with respect to the connection quality of the device finally used to deliver the content to the user.

- To offer the user with the ability to choose the appropriate available content based on their needs (i.e. if the same content is available on text, audio, video, subtitled video or sign language video)
- To provide access through either the graphical user interface or a voice driven interface depending on the users' needs always using existing popular already installed mobile applications.
- To harness the functionality and capability of existing hardware and services to minimize the footprint of the resulting mTEL app (thus providing quicker time to market, lower cost, lower complexity and reduced overhead).

To summarize, the approach places mTEL application in a central position between applications, learners and staff, already use (social networks, messengers, telephony, streaming, etc.) including eLearning application activities and content, thus creating a learning community that is not bounded by any technology, media, location, content or time. Hence, learning activities are not anymore restricted to be performed only within eLearning applications on the web, but are made available through all popular technologies people currently already use as described in Fig. 1: mTEL UML Diagram. The detailed operation of the mTEL model will be described with use-case examples at the following sections.

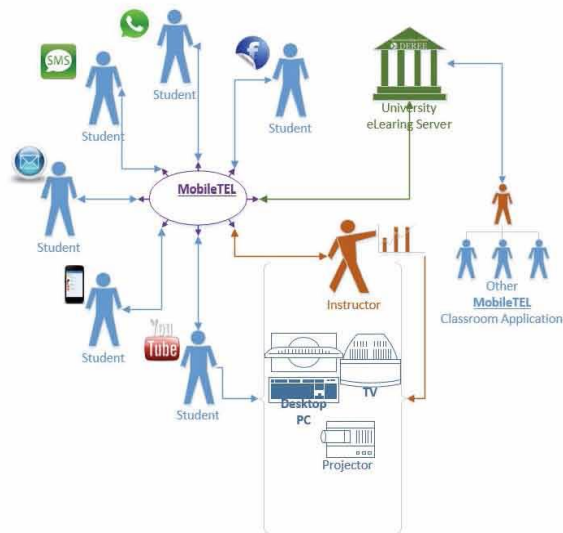


Fig. 1: mTEL UML Diagram.

3.2 Specifications

In this section, a detailed list of the theoretical mTEL application is presented.

- 1 **User Multiple Login:** Every user of the mTEL app needs to be identified. Identification plays as very important role since it is required to assign the right user to the right institution and related content areas but also the right role in the application (student, instructor). In addition, it is required so that the appropriate credentials are sent to all already setup cooperating applications (like Facebook, Viber Messenger, email, etc. with the exception of cell phone services like calls or SMS, which are coordinated through the device's SIM card).

- 2 Graphical User Interface: The mTEL is mainly using already, installed mobile applications and services like Facebook Messenger, email, SMS, etc. Therefore, in terms of GUI, the requirements are minimal through one main screen that covers the following options:

- a) Notifications button which provides access to a notifications list from all setup mobile applications and services.
- b) Setup button which provides access to a menu of options to setup mTEL connectivity with the existing applications and services available to the users.
- c) An on/off button which enables or disables the voice command system.

For that reason, mTEL's GUI mostly relies on Apple's recorded guide for iOS designing [16], and Android Design Principles [17], mostly to verify that there are only a very limited number of ways for doing this, same with what empirical observation of existing popular mobile applications use which are pretty much the same with most applications that the user will connect the mTEL to. For example, the settings button leads to a settings menu which is similar to the one used by Facebook, Google Mail or Viber.

- 3 A content sharing system capable of using common wireless communication methods available for mobile devices such as Wi-Fi, Bluetooth, NFC, Android Beam, etc., with the provision to forward content at the appropriate available quality aligned to the forwarding communication method quality, content and size. For example, receiving streaming video accessed by your mobile phone through Wi-Fi, in order to transmit it to a laptop via Bluetooth at real-time. (please see Technical Issues section)
- 4 A mobile Virtual Class system that enables the instructor to disseminate content to a group of students who are all using the mTEL at a pre-scheduled time.
- 5 Ability to initiate on-line activities using the institutional eLearning application web page while undertaking the responsibility to communicate and disseminate (where possible) bidirectional information and assets either directly through mTEL or using any of the popular commonly used on-line and mobile services. For example, the instructor places a certain question at a Blackboard (Bb) LMS Discussion Board. Traditionally, Bb will send an email to all subscribed users of that forum. However, if mTEL is used, then the message will be transmitted by all currently mTEL configured methods like a post at the course's Facebook (Fb) Page timeline, a Fb private message, an email, an SMS and a Viber message. That way, the opportunity of drastically increasing the engagement of students is considerably amplified. Based on the same logic, students may respond with the same engagement benefits and soon enough there is critical mass for an asynchronous conversation to begin without the constraints of place, time, and physical contact. Moreover, this example exhibits a constructivist approach in learning [18] since learning is acquired through a group effort with community support by peers and instructors or even subject experts if invited. For servicing all these activities the mTEL should also provide a multipurpose editor that may be used alternatively to cooperating services or for the creation of new content where applicable.
- 6 The application should be able to receive and provide notifications from all connected platforms and technologies in one single place. Additionally, it will provide the functionality of accessing and responding to the related content but also create and push new content to any connected platform from within the application where possible and meaningful hence also supporting the specifications 4 and 5.
- 7 Voice-to-text Interface and Voice-Commands Recognition: Voice commands recognition system and voice-to-text conversion will provide the convenience of being able to use the application at hands-free mode possibly while the users' hands are occupied with something else like driving. This will also provide convenience for several categories of disabled people which may interact with the application without physical contact with the device.
- 8 Synchronization: mTEL will be able to connect to all configured cooperating applications (for example Facebook, Blackboard, email, Viber, etc.) when any interaction occurs (such as an assignment post or a question or announcement and generally any content) to retrieve information about new content relative to the mTEL activities or to the connected eLearning application but also push content to both students and cooperating applications and services so they all are all in the same page and promptly notified. Then action may be carried within the mTEL environment, if applicable, or by invoking the sending application on the user's phone (i.e. Facebook Pages Manager) where possible (Specification 9). Synchronization keeps mTEL

users updated to the current eLearning content and activities and motivates them to take on eLearning related activities thus initiating interactivity, which is in fact the main characteristic of constructive learning.

- 9 Finally, transition to the related to content third party service (i.e. Blackboard or Facebook or others) will be offered for the user to interact within the native application when required.

3.3 mTEL Architecture

The mTEL high level architecture is graphically demonstrated by the following diagram.



Fig. 2: Architectural Diagram

The mTEL high level architecture is graphically demonstrated by the following diagram.

Based on the architectural diagram (Fig. 2) the mTEL consists of two applications.

The main Mobile application is installed at the mobile device(s) of the member of the learning community. An auxiliary application is installed on an application server, which is responsible for the synchronization of the mTEL.

These components are referenced in detail in the following sections:

3.3.1 mTEL (Main Mobile Application)

The mTEL application is installed at mobile devices of the members of the learning community. Its purpose is to increase the engagement of the members of the learning community to any learning, or related, activity occurring at the web-based eLearning Platform.

To do so, the mTEL application model takes advantage of the benefits of existing technologies in an effort to provide real-time mobile interactivity. No consideration of their physical (geographic) location takes place, but instead, additional consideration is taken of the cyber-location to which they mostly spend their time. For example, students spend time in Facebook as part of their daily routine [25] but may never enter their course web site unless they need to access material for a summative assessment who's deadline is approaching. Additionally, according to Pempek [25], "Students communicated on Facebook using a one-to-many style, in which they were the creators disseminating content to their friends". Additionally, a study by Ahuja [26] indicates that students spend an increasing

amount of time accessing Facebook through its mobile app. However, the Facebook mobile app even if not used by the students it is always on and through it students, are constantly connected and receive notifications. Considering that this study refers only to Facebook, it is logical to assume that the time students are engaged to mobile applications services is much higher. Evidently, students do everything they would optimally be expected to do using an eLearning application, but with non-educational content in Facebook. Hence, it is safe to say that they already have the technological background required for using an eLearning application since they are of similar or simpler complexity and additionally they have the time to spend. The challenge is, whether it is possible to shift this already existing behavior and knowledge, (e.g. spending time in Social Networks, socially texting or using SMS), into learning activities, not only through the same media and applications but also through other popular communication technologies.

mTEL offers a notification center, where all material related to learning notifications is gathered in one place. The user may use the mTEL notification center to take any action required for any selected notification by invoking the application that has generated the notification. An example of this would be a course related content like an announcement or a forum post from Blackboard to be shared with the corresponding to the course Facebook page and therefore generate a notification for the members of this page (students taking the course) in the notification list of Facebook. Since students receive and view Facebook notifications anyhow for social reasons, they will also be "forced" to see a course related notification. Additionally, based on the user preference, the same announcement created at the eLearning platform may be made available through SMS, email or messengers which produce notifications at the phone's status bar, including mTEL, making certain that the message is conveyed to the members of the learning community.

Based on the architectural diagram, all outgoing communications are forwarded to the most appropriate application that has generated them. For a notification that has been received from multiple places, it is left to the student to choose the method and corresponding mobile application to be used. The innovation here is that the mTEL, uses existing popular technologies that are already installed at the mobile device of most users, instead of having these functions build-in. This eliminates the burden of development but also maintenance, since most of that, is taken care of the invoked 3rd party applications and not mTEL.

The mTEL Application Theoretical Model offers the specifications and the conceptual and contextual design for developing a mobile application. Such application that takes advantage of existing web and mobile technologies and user/student behavior. It also approaches eLearning for a new perspective that may shift a significant amount of students into investing the time they already spent in mainstream Internet applications, to learning activities.

One of the major mTEL innovations is that it monitors in real-time (through the auxiliary server-side application) all connected services and eventually Blackboard, that is used in our example. mTEL will replicate Blackboard's notification concerning the creation of a learning activity (e.g. a wiki) to all connected services including popular ones like Facebook. In the case of the Facebook example, the notification may be created as a status update at the Facebook page corresponding to the course for which the wiki was created. As a consequence, Facebook will create a notification and place it at the newsfeed. Since mTEL does all that at the background, it can be technically but also literally characterized as a "Ghost" application. Moreover, it delivers these services via mobile devices at any place the user may be, without geographic restrictions or technical restrictions apart from the necessity for an Internet connected mobile device.

In addition to that, mTEL offers all described functionality also via the voice command driven system offered by the user's mobile device (e.g. Siri, Google Now, etc.). This enables the user to access mTEL hands free, thus enabling them to engage with the learning community in parallel with other tasks they may be doing. For example, an instructor responds to status comment related to a coursework by commanding and dictating to mTEL verbally, while driving. Also, people that have difficulties with typing may find this the only way to use the learning technology.

Finally, mTEL is able to disseminate any content streamed or received to the most appropriate format with respect to the bandwidth available at any time. Again, this is a service that relies on existing, available services offered by mobile devices like Miracast (Android) and Airplay (iOS) or Bluetooth connectivity, etc. This permits a small, non-convenient device like a smartphone, to see content (like streaming video) and disseminate it to other available devices to the area like a Microsoft Surface or just a smart TV to display the content. Should the content be available in multiple formats, mTEL

implements technology to disseminate the one most suitable based on the communication quality. More technical details about this function will be referenced in the following section below.

3.3.2 *Sync TEL Auxiliary Application (Server Side)*

The auxiliary server side application acts as a distant synchronization service which checks all connected to the mTEL services for any activity related to learning content. For convenience the name Sync TEL will be used from now on in order to identify it. This is done in frequent intervals at an application server and not at the mTEL so that no extra mobile resources are used that could deplete the battery or cost carrier charges by producing unnecessary data traffic. Once any new activity is found, it is received by Sync TEL and is forwarded to the mTEL, updating the mobile device's notification bar and page and mTEL's notification system keeping the user's mobile device always updated to the latest learning related activities.

4 CONCLUSION

mTEL firstly, instead of bringing learners to eLearning, brings eLearning to learners everywhere and secondly, instead of trying to develop a mobile eLearning app that would offer a combination of successful market technologies, a mobile app that uses them through their native applications was developed. Based on these principles, mTEL achieves awareness of eLearning users with eLearning activities' updates using mobile applications most popular to users. So since literature review and surveys prove that learners favor most and spend a significant amount of their time on social media and messengers, mTEL brings eLearning notifications and the ability to interact into these, most preferred by user's apps. Evaluators of mTEL agreed that user awareness is a key factor in increasing engagement of users to eLearning activities. Furthermore, besides achieving the learning related goals of the application, it was necessary to consider that a key element to success for any application is the cost of maintenance and usability in technical terms. mTEL, utilizing existing technologies for the largest part of the provided service, transfers most of the maintenance and upgrading cost to those technologies hence becoming a very low maintenance cost application. At the same time, mTEL was designed in such way so that it mostly acts as a light aggregator of information that utilizes collaborating apps for processing eLearning requests. Consequently, mTEL does not burden the user's device, nor consumes their network bandwidth or incurs mobile telecommunications charges, all of which would be reasons for dissatisfying users enough to uninstall the application, even if they have recognized the benefits. Finally, mTEL is a simple idea and simplicity is well known to be a major benefit in application developing leading directly not only to development cost reduction but also user adoption. It offers an innovative, very simple, fast to respond, easy to use, low cost way to utilize and enable all modern popular technologies offered to learners, around and about learning, positively affecting the increase of the engagement of its users to learning.

5 FUTURE RESEARCH

Since mTEL is limited by the restriction of certain E-Learning platforms to collaborate with other applications, an area of research opens in producing a standardized framework that needs to be considered by popular eLearning and non-eLearning service providers in order to open the opportunity for collaboration with applications like mTEL. Such technologies are already available but are restrictive in allowing integration with other applications through APIs. This is possibly because, as most IT technologies, they are firstly designed to service commercial and non-educational needs of the market. Hopefully, this research and the proposed study may assist in recognizing a commercial value in learning that will attract the investments required to proceed to changes that will enable the development of a variety of learning technologies that may additionally offer very significant commercial opportunities.

This research may additionally be used as:

- A reference to the identified weaknesses of the administrative and technological implementations in Higher Education. From this study, it is evident that research is required to produce best practices in the following areas directly or indirectly related to eLearning.
- A starting point to understand the limitations of eLearning in relationship to their cost/benefit performance especially for long-term evaluation.

- A stepping stone to further research and understand the pedagogical and technical knowledge requirements necessary for constructive eLearning developers. Based on these findings, define standards and design training sessions that would provide the appropriate expertise required.

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Appendix VI – Experts’ CV

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Personal Information

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Education and training

- 2012** PhD in Multimedia in Education. University of Aveiro. Thesis title: The contribution of social web tools for knowledge construction: a case study.
2007 Specialized training course Diploma in Multimedia in Education. University of Aveiro.
2006 Short course Diploma in Advanced Language, Materials and Methodology for Teachers of English. Norwich Institute for Language Education.
2003 Master Diploma in Logopedics. Universitat de Vic, Barcelona. Dissertation title: Anomic Aphasia: a case study.
2001 Degree in English and German Teaching (five-year programme). University of Aveiro.

Professional Experience

- Nov 2015 -** Postdoctoral Research Fellow at the University of Aveiro under Grant SFRH/BPD/100367/2014. Research project entitled "EduLabs - evaluating their impact on students' digital competence: a study in Portuguese middle schools".
Oct 2013 – Oct 2015 Postdoctoral Research Fellow at the University of Aveiro under Grant BPD/UI57/5303/2013. Research project entitled "Evaluating the impact of restructuring secondary education in East Timor – a study in the context of international cooperation".
Sept 2012 – Aug 2013 Secondary School Teacher in Special Educational Needs for the deaf and hearing impaired.
May 2008 – Sept 2012 Doctoral Research Fellow at the University of Aveiro under Grant SFRH/BD/41797/2007. Research project entitled "The contribution of social web tools for knowledge construction: a case study". Visiting Researcher at Ghent University, Belgium between September – November 2010.
Nov 2007 – Feb 2008 Assistant Teacher at the University of Aveiro, monitoring the curricular units of Learning Environments Management and Multimedia and Cognitive Architectures of the Master Course in Multimedia in Education.
Oct 2002 – Feb 2007 Teacher of Vocational English in Professional Training Courses incl. Computing Systems Management; Distributed Networks; Electricity; Business, Multimedia, among others.
Sep 2002 – Sept 2006 Assistant Teacher at the Portuguese Institute of Marketing Management. Responsible for the syllabus and curricular units of Business English I and II.
Sept 2000 – Jan 2008 Basic, Secondary and Adult Education Teacher of English and German as Foreign Languages.

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Research projects

- 2016 – 2018** Mobile Learning, Augmented Reality and Geocaching in Science Education – an innovator design-based research project.
- 2013 - 2015** Evaluating the impact of restructuring secondary education in East Timor - a study in the context of international cooperation. Provided by [PTCRIS: 132265](#).
- 2011 - 2014** Portuguese Public Higher Education Use of Communication Technologies. Provided by [PTCRIS: 113368](#).

Scientific and technical production**Published books**

1. Almeida, P., Balula, A., Batista, J., Coelho, D., Lucas, M., Morais, N., Moreira, A. ... Souza, F. (2014). *Uso das Tecnologias da Comunicação no Ensino Superior Público Português: análise, sistematização e visualização de informação nas perspetivas institucional e docente*. Aveiro: UA Editora.
2. Cabrita, I., Lucas, M., Capelo, A., Ferreira, A., Santos, C., Morgado, M., ... Breda, Z. (2015). *Implementar a Reestruturação Curricular do Ensino Secundário Geral em Timor-Leste: Construindo Qualidade*. Aveiro: UA Editora.
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Published book chapters

1. Lucas, M., & Cabrita, I. (2015). Impact Evaluation at the Convergence of Evidence Based Policy and Monitoring and Evaluation: A Study in Timor-Leste. In R. V. Nata (Ed.), *Progress in Education: Vol. 34*. (pp. 53-69). Hauppauge, N.Y. USA: Nova Science Publishers.
2. Ramos, F., Pinto, M., Coelho, D., Raposo, R., Pombo, L., Pedro, L., ... Moreira, A. (2015). Tracing the use of Communication Technologies in Higher Education. In F. Ribeiro, Y. Politis & B. Culum (Eds.). *New Voices in Higher Education Research and Scholarship* (pp. 157-174). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-7244-4.ch008
3. Lucas, M. (2014). Map of Relational Links – Visualizing knowledge construction. In T. Ley, S. de Freitas & C. Rensing (Eds.), *Lecture Notes in Computer Science: Vol. 8719. Open Learning and Teaching in Educational Communities* (pp. 574-575). doi: 10.1007/978-3-319-11200-8_76
4. Lucas, M., Ribeiro, J., & Moreira, A. (2013). Bypassing School Disenchantment: Strategies to Promote School Attainment. In M. D. Lytras et al. (Eds.), *Communications in Computer and Information Science: Vol. 278. Information Systems, E-learning, and Knowledge Management Research* (pp. 1-6). doi: 10.1007/978-3-642-35879-1_1
5. Lucas, M., & Moreira, A. (2012). Empowering Teachers through Social Networking. In R. N. Linhares, S. Lucena & A. Versutti (Eds.), *As Redes Sociais e seu impacto na Cultura e na Educação do século XX* (pp. 149-166). Fortaleza: Edições UFC.
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7. Lucas, M., & Moreira, A. (2009). Bridging Formal and Informal Learning - A Case Study on Students' Perceptions of the Use of Social Networking Tools. In U. Cress, V. Dimitrova, & M. Specht (Eds.). *Lecture Notes in Computer Science: Vol. 5794. Learning in the Synergy of Multiple Disciplines* (pp. 325- 337). doi: 10.1007/978-3-642-04636-0_31
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1. Lucas, M., Santos, S. (2015). The integration of ICT in the new Timorese General Secondary Curriculum. *Indagatio Didactica*, 7(2), 30-42.
2. Lucas, M., Cabrita, I., & Ferreira, A. (2015). Pathways to change: Improving the quality of Education in Timor-Leste. *Procedia Social and Behavioral Sciences*, 186, 732-738. doi:10.1016/j.sbspro.2015.04.103
3. Cabrita, I., Lucas, M., & Capelo, A. (2015). Maths in-service teacher training and the restructuring of secondary education in East-Timor. *Procedia Social and Behavioral Sciences*, 186, 649-655. doi:10.1016/j.sbspro.2015.04.129
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1. Cabrita, I., & Lucas, M. (2015). Conceções e práticas em matemática no ensino secundário geral em Timor-Leste. *Proceedings from CiEMeLP2015: Conferência Internacional do Espaço Matemático em Língua Portuguesa* (s/pp.).
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3. Cabrita, I., Lucas, M., & Silva, L. (2015). Teaching and learning mathematics: the voice of Timorese teachers and students. In Beswick, K., Muir, T., & Wells, J. (Eds.), *Proceedings of the 39th Conference of the International Group for the Psychology of Mathematics Education: Vol. 1* (p. 217).
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9. Lucas, M., & Moreira, A. (2009). Fostering Learning with Social Web Tools: Examples from Portugal. *Proceedings of the International Education and New Learning Technologies - Edulearn2009* (pp. 5176-5184). Barcelona: IATED.
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Event Participation

Participation as Member of Committees, Boards and Chairman

1. Member of the Scientific Committee of the Conference "Tracer – The Use of ICT in Portuguese Higher Education". Aveiro – Portugal, 2014.
2. Member of the Organizing Committee of the Conference Tracer – The Use of ICT in Portuguese Higher Education. Aveiro – Portugal, 2014.
3. Invited reviewer for the Journal of Online Learning and Teaching, since 2014.
4. Chair of the panel Challenges and Institutional Perspectives in the Conference Tracer – The Use of ICT in Portuguese Higher Education. Aveiro – Portugal, 2014.
5. Member of the Scientific Committee of the 3rd International Conference on Technology Enhanced Learning, Quality of Teaching and Reforming Education. Barcelona – Spain, 2012.
6. Member of the Organizing Committee of the 1st National Meeting Superar Barreiras com TIC. Aveiro – Portugal, 2011.
7. Member of the Organizing Committee of the International Council for Educational Media (ICEM) and the International Symposium on Computers in Education (SILE) Conference, Aveiro – Portugal, 2011.
8. Chair of the ICT in Teacher Education Track in the 4th World Summit on the Knowledge Society. Mykonos – Greece, 2011.
9. Member of the Scientific Committee of the 1st International Conference on Technology Enhanced Learning, Quality of Teaching and Reforming Education. Athens – Greece, 2010.
10. Member of the International Scientific Advisory Board of INTED2010 - International Technology, Education and Development Conference. Valencia – Spain, 2010.
11. Member of the Editorial Review Board of the International Journal of Knowledge Society Research (IJKSR). DOI: 10.4018/IJKSR, since 2010.
12. Member of the Scientific Commission and Editorial Review Board of the Internet Latent Corpus Journal (ILCJ). ISSN: 1647-7308, since 2009.

Oral Presenter Participation

1. Lucas, M. (2015, July). *Timorese general secondary mathematics curriculum: students' perspectives on its implementation*. Paper presented at the 39th Conference of the International Group for the Psychology of Mathematics Education, Hobart, Australia.
2. Lucas, M. (2015, July). *Teaching and learning mathematics: the voice of Timorese teachers and students*. Poster presented at the 39th Conference of the International Group for the Psychology of Mathematics Education, Hobart, Australia.
3. Lucas, M. (2014, October). *Pathways to change: Improving the quality of Education in Timor-Leste*. Paper presented at the 5th World Conference on Learning, Teaching and Educational Leadership, Prague – Czech Republic.
4. Lucas, M. (2014, October). *Maths in-service teacher training and the restructuring of secondary education in East-Timor*. Paper presented at the 5th World Conference on Learning, Teaching and Educational Leadership, Prague – Czech Republic.

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5. Lucas, M. (2014, October). *Crossing boundaries: teacher trainers and science curriculum implementation in East Timor*. Paper presented at the 5th World Conference on Learning, Teaching and Educational Leadership, Prague – Czech Republic.
6. Lucas, M. (2014, June). *ICT and competence development: a case study*. Paper presented at the 9th Iberian Conference on Information Systems and Technologies, Barcelona – Spain.
7. Lucas, M. (2013, July). *Análise de Interações Online: um contributo para o estado da arte*. Paper presented at the VIII International Conference on ICT in Education - Challenges 2013, Braga – Portugal.
8. Lucas, M. (2013, June). *The Interaction Analysis Model: an overview*. Paper presented at the 6th World Summit on the Knowledge Society, Aveiro – Portugal.
9. Lucas, M. (2012, February). *Discussing two new approaches to analyze knowledge construction in TEL environments*. Paper presented at the International Conference on Educational Research, Lefkosa – North Cyprus.
10. Lucas, M. (2011, September). *Bypassing School Disenchantment: Strategies to Promote School Attainment*. Paper presented at the 4th World Summit on the Knowledge Society 2011, Mykonos – Greece.
11. Lucas, M. (2010, May). *Knowledge Construction with Social Web Tools*. Paper presented at the 1st International Conference on Technology Enhanced Learning, Quality of Teaching and Reforming Education. Athens – Greece.
12. Lucas, M. (2009, September). *Bridging Formal and Informal Learning - A Case Study on Students' Perceptions of the Use of Social Networking Tools*. Paper presented at the 6th European Conference on Technology Enhanced Learning, Nice – France.
13. Lucas, M. (2009, June). *Social Web Tools for the Education of Educators - a case study*. Paper presented at the IADIS International Conference e-Learning 2009, Algarve – Portugal.
14. Lucas, M. (2009, May). *A Web Social: Complemento Informal às Aprendizagens Formais?* Paper presented at the VI International Conference on ICT in Education - Challenges 2009, Braga – Portugal.
15. Lucas, M. (2009, July). *Fostering Learning with Social Web Tools: Examples from Portugal*. Paper presented at the International Conference on Education and New Learning Technologies - EDULEARN09. Barcelona – Spain.

Invited Talk

1. SAPO Campus: a communication and collaboration network for the entire school community. José Ferreira Pinto Basto Basic School, Ílhavo – Portugal, 2012.
2. GoogleDocs for Teachers. José Ferreira Pinto Basto Basic School, Ílhavo – Portugal, 2011.
3. New meanings in Teacher Training: Multimedia and Language Teaching. Paula Frassinetti School of Education, Porto – Portugal, 2008.

Curriculum vitae

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Education

- | | |
|-------------|--|
| 2000 – 2005 | Ph.D. – pedagogy
Faculty of Pedagogy, Charles University in Prague
Thesis: "The Role of Faculty in Distance Education" |
| 2000 – 2001 | Distance Education Course
National Distance Education Centre, Prague |
| 1999 – 2000 | Higher Education Questions Course
Faculty of Pedagogy, Charles University in Prague |
| 1994 – 1998 | Masters Degree – elementary school teaching of French and music
Faculty of Pedagogy, University of West Bohemia in Pilsen |

Mobility

- | | |
|------|--|
| 1999 | Stay "Concevoir les dispositifs ouverts et à distance",
Centre National d'Enseignement à Distance, Poitiers, France |
| 2011 | English Language Course
Embassy CES, London, Great Britain |

Employment

- | | |
|-------------|--|
| 1998 – 2016 | University of West Bohemia in Pilsen: senior researcher and lecturer;
over the years acting at various positions including vice-dean and
director of distance education centre |
| 2012 - 2014 | Fraus Publishing House, Pilsen: author and editor of textbooks, ebooks
and electronic support materials; education methodology specialist |
| 1998 – 1999 | Catholic Lyceum, Pilsen: teacher – music (taught in French) |
| 1997 – 2001 | 10. Elementary School, Pilsen: teacher – music (taught in French) |
| 1994 – 1998 | School of Music YAMAHA, Pilsen: teacher – flute |

Recent Publications

1. Hrtoňová, N., Kohout, J., Rohlíková, L., & Zounek, J. (2015). Factors Influencing Acceptance of E-learning by Teachers in the Czech Republic. *Computers in Human Behavior*, 51, p. 873–879. DOI: 10.1016/j.chb.2014.11.018.
2. Neumajer, O. Rohlíková, L., & Zounek, J. (2015). *Učíme se s tabletem. Využití mobilních technologií ve vzdělávání*. Praha: Wolters Kluwer, a.s., 2015. 192 s. ISBN 978-80-7478-768-3.
3. Rohlíková, L., & Vejvodová, J. (2014). Blended Learning in Education of Faculty Members. *International Journal of Knowledge Society Research (IJKSR)*, 5(3), 25–34. doi:10.4018/ijksr.2014070103
4. Rohlíková, L., Vejvodová, J., & Rohlík, O. (2014). Case Study: Efficiency of Blended Learning in SMART Board Training for Teachers. *International Journal of Knowledge Society Research (IJKSR)*, 5(3), 35–42. doi:10.4018/ijksr.2014070104
5. Bureš, M., Příbáň, T., & Rohlíková, L. (2014). Attitudes of students at higher education institutions towards ICT in education. In 10th International Scientific Conference on Distance Learning in Applied Informatics. Praha: Wolters Kluwer ČR. s. 263–273. ISBN: 978-80-7478-497-2
6. Rohlíková, L., Vejvodová, J., & Rohlík, O. (2014). Towards Promoting Active learning in On-line Courses for Lecturers in Further Education: Experience and Observations. In *DiVAI 2012 : 9th International Scientific Conference on Distance Learning in Applied Informatics: Conference Proceedings*. Nitra: Constantine the Philosopher University in Nitra, 2012. s. 269–278. ISBN: 978-80-558-0092-9
7. Motschnig-Pitrik, R., & Rohlíková, L. (2013). Constructivist and Person-Centered Learning in Higher Education ? Using Indicators and Case Examples for Comparing Good Practice. In *Information Systems, E-learning, and Knowledge Management Research. 4th World Summit on the Knowledge Society, WSKS 2011*. Mykonos, Greece, September 21–23, 2011. Revised Selected Papers. Berlin Heidelberg: Springer-Verlag. s. 44–57. ISBN: 978-3-642-35878-4 , ISSN: 1865-0929
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2014

Miltiadis D. Lytras, Ph.D.

RESEARCH PROFILE – CURRICULUM VITAE

LAST UPDATE: OCTOBER 2014

<p>SOCIAL WEB EVOLUTION Emerging Semantic Applications and Web 2.0 Technologies Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Semantic Web-Based Information Systems Role of the AI Applications Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Visioning and Engineering the Knowledge Society A Web Science Perspective Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Trends and Effects of Technology Advancement in the Knowledge Society Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Open Source for Knowledge and Learning Management Miltiadis D. Lytras & Francisco Orús de Pablos</p>
<p>Semantic Web Personalization and Context Awareness Management of Personal Resources and Personalized Web Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>KNOWLEDGE NETWORKS Bio-Social Software Perspective Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Web 2.0 The Business Model Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>DIGITAL CULTURE AND E-TOURISM Technologies, Applications and Management Approaches Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>The China Information Technology Handbook Miltiadis D. Lytras & Francisco Orús de Pablos</p>
<p>INTERNATIONAL JOURNAL OF Knowledge Society Research Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>The Semantic Web Real World Applications from Industry Jorge Lopez, Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Emerging Topics and Technologies in Information Systems Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Intelligent Learning Infrastructure for Knowledge Intensive Organizations A SEMANTIC WEB PERSPECTIVE Miltiadis D. Lytras & Francisco Orús de Pablos</p>	<p>Technology Enhanced Learning BEST PRACTICES Miltiadis D. Lytras & Francisco Orús de Pablos</p>
<p>Specialization: Knowledge Management, E-Learning, Semantic Web, Open Source Technologies, Knowledge Society, Social Networks, Information Technology for Innovation and Sustainable Development</p>				

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Curriculum Vitae

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Short Bio

Miltiadis D. Lytras is a Research Professor with a research focus on semantic web, knowledge management and e-learning, with more than 150 publications in these areas.

He has co-edited 45 special issues in International Journals (e.g. IEEE Transaction on Knowledge and Data Engineering, IEEE Internet Computing, IEEE Transactions on Education, Computers in Human Behaviour, Interactive Learning Environments, Journal of Knowledge Management, Journal of Computer Assisted Learning).

He has authored/[co-]edited 50 books in International publishers[e.g. Open Source for Knowledge and Learning Management, Ubiquitous and Pervasive Knowledge Management, Intelligent Learning Infrastructures for Knowledge Intensive Organizations, Semantic Web Based Information Systems, China Information Technology Handbook, Real World Applications of Semantic Web and Ontologies, Web 2.0: The Business Model, etc].

He has served as the (Co) Editor in Chief of 12 international journals [e.g. International Journal of Knowledge and Learning, International Journal of Technology Enhanced Learning, International Journal on Social and Humanistic Computing, International Journal on Semantic Web and Information Systems] while he is associate editor or editorial board member on seven more.

Personal Details:

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Place of Birth:	Tripolis, Greece
Marital Status:	Married, Three Kids

1. EDUCATION

2004, Ph.D. "An ontological approach for the specification of Semantics for Learning Purposes: The convergence of Knowledge Management and E-learning", Athens University of Economics and Business, Greece, <http://www.aueb.gr>

1995-1996, Master in Business Administration, Athens University of Economics and Business

1997, Postgraduate Diploma in Adults Education, School of Pedagogical and Technical Education (ASPETE), Patras, Greece

1995, Bachelor, Informatics, Athens University of Economics and Business

2. WORKING EXPERIENCE

1992	Informatics Department, Olympic Airways
1996-1999	Informatics Teacher of Secondary Education
1999-2002	Manager and Co-Owner ATRAC Group Ltd Advanced Training and Consulting Group Senior Researcher, Research Center of AUEB
2000-2004	Assistant Professor TEI Athens,
2004-2005	Assistant Professor, Department of Computer Engineering Department, University of Patras
2004-2008	Professor/ Research Professor, American
2005-today	College of Greece

3. RESEARCH INTERESTS

Knowledge Management, Knowledge Society, Technology enhanced Learning, Semantic Web. Open Source Technologies, IT enabled Innovation, sustainable Development, and Entrepreneurship

4. PUBLICATIONS

4.1 Publications in Peer Reviewed International Journals listed in ISI SCI/SSCI

1. Miltiadis D. Lytras, Eugenijus Kurilovas: Special issue on Information and communication technologies for human capital development. *Computers in Human Behavior* 30: 361 (2014)
2. Maria-Iuliana Dascalu, Constanta-Nicoleta Bodea, Miltiadis D. Lytras, Patricia Ordóñez de Pablos, Alexandru Burlacu: Improving e-learning communities through optimal composition of multidisciplinary learning groups. *Computers in Human Behavior* 30: 362-371 (2014)
3. Miltiadis D. Lytras, Francisco J. García-Peñalvo, Patricia Ordóñez de Pablos: Advanced human-computer interaction. *Computers in Human Behavior* 29(2): 305-306 (2013)
4. Leyla Zhuhadar, Rong Yang, Miltiadis D. Lytras: The impact of Social Multimedia Systems on cyberlearners. *Computers in Human Behavior* 29(2): 378-385 (2013)
5. Francisco José García Peñalvo, Ricardo Colomo Palacios, Miltiadis D. Lytras: Informal learning in work environments: training with the Social Web in the workplace. *Behaviour & IT* 31(8): 753-755 (2012)
6. Francisco José García Peñalvo, Ricardo Colomo Palacios, Miltiadis D. Lytras: Outcomes of International Research Projects on Technology Applied to Education. *J. UCS* 18(1): 1-4 (2012)
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12. Miltiadis D. Lytras, Patricia Ordóñez de Pablos: Software Technologies in Knowledge Society. *J. UCS* 17(9): 1219-1221 (2011)
13. Miltiadis D. Lytras: From the Special Issue Editor: Information Systems Research for a Sustainable Knowledge Society. *IS Management* 27(3): 196-197 (2010)
14. Maria Vargas-Vera, Miltiadis D. Lytras: AQUA: A Closed-Domain Question Answering System. *IS Management* 27(3): 217-225 (2010)
15. Miltiadis D. Lytras, David Castillo-Merino, Enric Serradell-López: New Human Resources Practices, Technology and Their Impact on SMEs' Efficiency. *IS Management* 27(3): 267-273 (2010)
16. Ernesto Damiani, Miltiadis D. Lytras, Philippe Cudré-Mauroux: Guest Editorial: Special Issue on Human-Centered Web Science. *World Wide Web* 13(1-2): 1-2 (2010)
17. Vossen G, Lytras M., Koudas N., "Knowledge and Data Engineering in the Semantic Web Era", in *IEEE Transactions on Knowledge and Data Engineering*, 19(2) 2007, [ISI Journal Rankings, Impact Factor 2005: 1.758]
18. Davies J., Lytras M., and Sheth P., "Semantic-Web-Based Knowledge Management", *IEEE Internet Computing*, vol. 11, no. 5, 2007, pp. 14-16 [ISI Journal Rankings, Impact Factor 2005: 2.5]
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20. Lytras M., Naeve A., "Semantic E-learning: Synthesizing Fantasies", in *British Journal of Educational Technology*, 37(3) 2006: 479-491 [ISI Journal Rankings, Impact Factor 2005: 0.593]
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- 321-330 [ISI Journal Rankings, Impact Factor 2005: 0.593]
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42. Miltiadis D. Lytras, Patricia Ordonez de Pablos, The Role of a "Make" or Internal Human Resource Management System in Spanish Manufacturing, *Human Factors and Ergonomics in Manufacturing, Vol. 18 (4) 1–16 (2008)*, Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/hfm.20117 [ISI Journal Rankings, Impact Factor 2005: 0.356]

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1. Miltiadis D. Lytras, Nancy Pouloudi, and A. Poulymenakou (2002), "Knowledge Management Convergence: Expanding Learning Frontiers". *Journal of Knowledge Management*, Vol. 6(1): pp: 40-51.
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3. Miltiadis D. Lytras, Nancy Pouloudi (2003), "Project management as a knowledge management primer: The learning infrastructure in knowledge intensive organizations. Projects as knowledge transformations and beyond", *Learning Organization Journal*, Vol 10(4): pp: 237-250
4. Miltiadis D. Lytras, Nancy Pouloudi, (2006), "Towards the development of a novel taxonomy of knowledge management systems from a learning perspective". *Journal of Knowledge Management*, Vol. 10(6):64-80 2006
5. Lytras M., Naeve A., Pouloudi A (2005), "Knowledge Management as a Reference Theory for E-learning: A conceptual and technological perspective", *International Journal of Distance Education Technologies*, 3(2):66-73
6. Lytras M., Naeve A., Pouloudi A. (2005), "A knowledge management roadmap for e-learning: The way ahead", *International Journal of Distance Education Technologies*, 3(2), pp: 1-11
7. Lytras M., Sicilia M. (2005), "Knowledge Society a Manifesto for Knowledge and Learning", in *International Journal of Knowledge and Learning*, 1(1), pp: 1-11
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9. Lytras M., Sicilia M., Davies J., Kashyap V., (2005) "Digital Libraries in the Knowledge Era: Knowledge Management and Semantic Web Technologies", in *Library Management Journal* on same theme, 26(4&5): 170-176
10. Sicilia M., Lytras M. (2005), "Scenario-Oriented Reusable Learning Object Characterizations", in *International Journal of Knowledge and Learning*, Vol. 1, No.4 pp. 332 - 341
11. Sicilia M., Lytras M. (2005), "On the representation of change according to different ontologies of learning", in *International Journal of Learning and Change*, Vol. 1, No.1 pp. 66 - 79
12. Mesa JA, , Rodriguez-Garcia D. , Lytras M., (2005), An Outlook for Ubiquitous Computing: Computing Power Anywhere and in Any Device, *UPGRADE Vol. VI, No. 5, October 2005*, pp: 2-7,
13. Lytras M., Iyer L., Tsakalidis A., "Exploiting Knowledge Management for Ubiquitous E-Government in the Semantic Web Era", in *Electronic Government, an International Journal – (Guest Editorial)*
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15. Sicilia M., Lytras M. (2005) The semantic learning organization, *The Learning Organization Journal*, Volume: 12 Issue: 5: 402 - 410
16. Sicilia M., Lytras M. (2006), Milestones and Requirements for introducing Semantic Web concepts in Information Systems Programs", in *Int. J. Information and Operations Management Education*, 1(3):281 - 294
17. Lytras M., Sicilia M, Kinshuk, Smapson D., "Semantic And Social Aspects of Learning in Organizations", *The Learning Organization Journal*, Volume: 12 Issue: (Guest Editorial)
18. Lytras M., Ordóñez P., Mantziou, M. (2007) Information And Communication Technologies And Management of Education, *International Journal of Management in Education (IJMIE)*, 1(3):193-198.
19. Lytras M., Ordóñez P., Mantziou, M. (2007). Information and communication technologies and challenges for the management of education: new managerial perspectives, *International Journal of Management in Education (IJMIE)*, 1(3):199-213.
20. Lytras M., Carroll J. (2007), Information Systems: The New Research Agenda, the Emerging Curriculum and the New Teaching Paradigm, *International Journal of Teaching and Case Studies (IJTCS)*, 1(1&2):10-14
21. Lytras M., (2007), Teaching in the knowledge society: an art of passion, *International Journal of Teaching and Case Studies (IJTCS)*, 1(1&2):1-9
22. Lytras M., Ordóñez de Pablos P. (2007), "Red Gate Corner: a Web 2.0 prototype for knowledge and learning concerning China business and culture", in *International Journal of Knowledge and Learning*, 3(4&5), pp: 542-548
23. Lytras M. Rafaeli S., Downes S., Naeve A., Ordóñez de Pablos P. (2007), Learning and Interacting in the Web: Social Networks and Social Software in the Web 2.0 Guest Editorial, *International Journal of Knowledge and Learning*, 3(4&5), pp: 367-371 Miltiadis D. Lytras, Ambjörn Naeve, Miguel-Angel Sicilia, Competencies Management: Integrating Semantic Web and Technology Enhanced Learning approaches for effective Knowledge Management, Guest Editorial, *Journal of Knowledge Management*, Volume 12, No. 6, 2008
24. Ambjörn Naeve, Miguel-Angel Sicilia and Miltiadis D. Lytras, Learning processes and processing learning: from organizational needs to learning designs, *Journal of Knowledge Management*, Volume 12, No. 6, 2008
25. Miltiadis D. Lytras and Patricia Ordóñez de Pablos, Competencies and Human Resource management: Implications for Organizational Competitive Advantage, *Journal of Knowledge Management*, Volume 12, No. 6, 2008
26. Miltiadis D. Lytras and Miguel-Angel Sicilia, Modeling the Organizational Aspects of Learning Objects in Semantic Web Approaches to Information Systems, *Interdisciplinary Journal on Knowledge and Learning Objects*, Vol. 1 (2005), pp:255-267
27. Miltiadis D. Lytras and Miguel-Angel Sicilia, Open research – the ORS way, *UOC-Papers*, e-journal for the Knowledge Society, 6(2008)
28. Yiannis Panagis, Evangelos Sakkopoulos*, Athanasios Tsakalidis and Giannis Tzimas, Spiros Sirmakessis, Miltiadis D. Lytras, Techniques for mining the design of e-government services to enhance end-user experience, *IJ of Electronic Democracy*, 1(1&2) 2008, pp:1-17
29. Evangelos Sakkopoulos, Efrosini Sourla, Athanasios Tsakalidis, Miltiadis Lytras, Integrated System for e-Health Advisory Web Services Provision using Broadband Networks, *IJ of Social and Humanistic Computing*, 1(1&2) 2008
30. Ambjörn Naeve, Pertti Yli-Luoma, Milos Kravcik, Miltiadis Lytras, A Modeling Approach to studying learning processes with a focus on knowledge creation, *IJ of Technology Enhanced Learning*, 1(1&2) 2008
31. Maria Vargas-Vera, Miltiadis D. Lytras (2008), Exploiting Semantic Web and Ontologies for Personalized Learning Services: Towards semantic web enabled learning portals for real learning experiences, *International Journal of Knowledge and Learning* 4(1) 1-16
32. Roberto Garcia, Miltiadis D. Lytras (2008), Semantic Web Applications: A framework for industry and business exploitation – What is needed for the adoption of the Semantic Web from the market and industry, , *International Journal of Knowledge and Learning* 4(2) 1-18
33. Jérôme Darmont, Miltiadis D. Lytras (2008), Semantic Web Knowledge Mining: Analyzing the Requirements for bringing knowledge out of Web data. The exploitation of Deep Web in the Semantic Web Era – Semantic Web Data warehouses, *International Journal of Knowledge and Learning* 4(2) 86-100
34. Ernesto D'Avanzo , Tsvika Kuflik, Miltiadis D. Lytras (2008), Building and using domain ontologies for learning in various domains, *International Journal of Knowledge and Learning* 4(3) 18-32

35. Miltiadis Lytras, Leyla Zhuhadar (2008), Semantic Annotation and Metadata for Accessible Learning Objects, *International Journal of Technology Enhanced Learning* 1(4) 2008, pp: 1-13
36. Miltiadis Lytras, Leyla Zhuhadar (2008), Data Mining in E-learning Environments: Ontologizing Profiles 1(3) 2008, pp: 14-25
37. Jérôme Darmont, Miltiadis D. Lytras (2008), Semantic Web for Electronic Government Applications: *International Journal of Electronic Democracy* 1(3) 1-14
38. Miltiadis Lytras, Ernesto Damiani (2008), Semantic Web and Ontologies for the Management of Cultural Heritage: Architecture Designs for Semantic Web based Digital Culture systems, *International Journal of Digital Culture* 1(1&2) 2008
39. Jérôme Darmont, Miltiadis D. Lytras (2008), Semantic Web for Electronic Government Applications: *International Journal of Electronic Democracy* 1(3) 1-14
40. Miltiadis D. Lytras, Liana Razmerita, Ontology Based User Modeling for E-Democracy Applications, *International Journal of Electronic Democracy* 1(3) 70-84
41. Roberto Garcia, Miltiadis Lytras (2008), Dynamic Paths Exploitation in Digital Culture Applications: A semantic Web perspective, *International Journal of Digital Culture and E-tourism* 1(1&2) 50-63
42. Ernesto D'Avanzo, Tsvika Kuflik, Miltiadis D. Lytras, roberto Garcia, Semantic Web Applications for E-business. (2008), *International Journal of E-Trade* 1(1&2) 2009, p44-60,

4.3 Publications in International Academic Conferences

1. Miltiadis D. Lytras, Marinos Themistocleous, Angeliki Tsilira (2003). „Towards the Semantic E-learning: An ontological oriented discussion of the new research agenda within the e-learning field“, Association for Information Systems, in the Proc. of Ninth Americas Conference on Information Systems, (AMCIS 2003), pp: 2985-2997
2. Miltiadis D. Lytras, Marinos Themistocleous, Angeliki Tsilira (2003). „A technology classification framework for e-learning purposes from a knowledge management perspective“, Association for Information Systems, in the Proc. of Ninth Americas Conference on Information Systems, (AMCIS 2003), pp: 2573-2582
3. Miltiadis D. Lytras, Marinos Themistocleous, Angeliki Tsilira (2003). „Peer-to-Peer Knowledge Networks and E-Learning Clusters of Applications: A Conceptual and Technological Approach of Potential Business Value“, Association for Information Systems, in the Proc. of Ninth Americas Conference on Information Systems, (AMCIS 2003), pp: 1782-1791
4. Miltiadis D. Lytras, Nancy Pouloudi (2001). „IT Skills utilization: From rhetorical verbalism to applied knowledge management e“. Association for Information Systems, 2001 In Strong, D., Straub, D. & DeGross, J.I. (Eds) *Proceedings of the Seventh Americas Conference on Information Systems*, (AMCIS 2001) [CD Proceedings], August 3-5, 2000, Boston,
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20. Martin Papadatos, Miltiadis Lytras, (2004), „Mobile and Wireless Technologies for learning: A ubiquitous milestone“, accepted for presentation in New Learning 2004, May 10-12, Skiathos, Greece
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26. Miltiadis D. Lytras, Georgios I. Doukidis 2000. „Exploitation of the Knowledge in Business Processes. MODEL: Multimedia for Open and Dynamic Executives Learning. An applied Knowledge Management system“ World Conference on the WWW and Internet (WebNet 2000), 29/10-4/11, 2000 San Antonio, Texas, USA

5. SCIENTIFIC EDITING

5.1 Summary

- Co-Editor in Chief 12 Peer Reviewed International Journals
- Associate Editor in Chief - 6 Peer Reviewed International Journals
- Editorial board member in 7 Peer Reviewed International Journals
- Book Series Co-Editor of four Book Series in USA Publishers
- Author of 3 books, (monographs)
- Co-Editor of 45 edited books on International Publishers
- Guest Editor of 26 special issues of International Journals listed in SCI/SSCI JCR ISI reports.
- Guest Editor of 32 special issues of International Journals not listed in SCI/SSCI JCR ISI reports.

5.2 Co-Editor in Chief of Peer Reviewed International Journals

- International Journal of Knowledge Society Research
- International Journal on Semantic Web and Information Systems International Journal of Knowledge and Learning
- International Journal of Technology Enhanced Learning
- International Journal of Teaching and Case Studies
- International Journal on Social and Humanistic Computing
- International Journal on Digital Culture and Electronic Tourism
- International Journal of Electronic Democracy
- International Journal of Electronic Banking
- International Journal of Electronic Trade
- International Journal of Entertainment Technology and Management,
- International Journal of Arab Culture, Management and Sustainable Development International Journal of Chinese Culture & Management
- International Journal of Learning and Change

5.3 Book Series Editor

- Advances in Semantic Web and Information Systems (ASWIS) Book Series Knowledge and Learning Society Series
- Advances in Emerging Information Technology Issues (AEITI) Book Series
- Advances in Strategic Management and Sustainable Development (ASMSD) Series

5.4 Associate Editor International Journals

International Journal of Metadata, Semantics and Ontologies (IJMSO)-
International Journal of Learning and Intellectual Capital
International Journal of Strategic Change Management
International Journal of Chinese Culture and Management

5.5 Guest Editor of special issues of International Journals listed in SCI/SSCI JCR ISI reports.

[this list needs update]

Miltiadis D. Lytras, [Eugenijus Kurilovas](#): **Special issue on Information and communication technologies for human capital development.** *Computers in Human Behavior* 30: 361 (2014)

Miltiadis D. Lytras, [Francisco J. García-Peñalvo](#), [Patricia Ordóñez de Pablos](#): **Advanced human-computer interaction.** *Computers in Human Behavior* 29(2): 305-306 (2013)

Patricia Ordóñez de Pablos, Miltiadis D. Lytras: **Editorial.** *J. Web Eng.* 12(5): 361-362 (2013)

Francisco José García Peñalvo, Ricardo Colomo Palacios, Miltiadis D. Lytras: **Informal learning in work environments: training with the Social Web in the workplace.** *Behaviour & IT* 31(8): 753-755 (2012)

Francisco José García Peñalvo, Ricardo Colomo Palacios, Miltiadis D. Lytras: **Outcomes of International Research Projects on Technology Applied to Education.** *J. UCS* 18(1): 1-4 (2012)

Francisco J. García-Peñalvo, Marc Alier Forment, Miltiadis D. Lytras: **Some Reflections about Service Oriented Architectures, Cloud Computing Applications, Services and Interoperability.** *J. UCS* 18(11): 1405-1409 (2012)

Miltiadis D. Lytras, [Patricia Ordóñez de Pablos](#): **Software Technologies in Knowledge Society.** *J. UCS* 17(9): 1219-1221 (2011)

Miltiadis D. Lytras: **From the Special Issue Editor: Information Systems Research for a Sustainable Knowledge Society.** *IS Management* 27(3): 196-197 (2010)

Ernesto Damiani, Miltiadis D. Lytras, Philippe Cudré-Mauroux: **Guest Editorial: Special Issue on Human-Centered Web Science.** *World Wide Web* 13(1-2): 1-2 (2010)

Ambjörn Naeve, Miguel-Ángel Sicilia, Miltiadis D. Lytras: **Learning processes and processing learning: from organizational needs to learning designs.** *J. Knowledge Management* 12(6): 5-14 (2008)

[John Davies](#), Miltiadis D. Lytras, Amit P. Sheth: **Guest Editors' Introduction: Semantic-Web-Based Knowledge Management.** *IEEE Internet Computing* 11(5): 14-16 (2007)

Miltiadis D. Lytras, [Walt Scacchi](#): **Guest Editorial Open-Source Software for Engineering Education: Pedagogical Strategies That Leverage Open-Source Tools.** *IEEE Trans. Education* 50(4): 290-291 (2007)

Dimitris Kanellopoulos, Evangelos Sakkopoulos, Miltiadis D. Lytras, Athanasios K. Tsakalidis: **Using Web-Based Teaching Interventions in Computer Science Courses.** *IEEE Trans. Education* 50(4): 338-344 (2007)

Gottfried Vossen, Miltiadis D. Lytras, Nick Koudas: **Editorial: Revisiting the (Machine) Semantic Web: The Missing Layers for the Human Semantic Web.** IEEE Trans. Knowl. Data Eng. 19(2): 145-148 (2007)

[Demetrios G. Sampson](#), Miltiadis D. Lytras, Gerd Wagner, Paloma Díaz: **Ontologies and the Semantic Web for E-learning (Guest editorial).** Educational Technology & Society 7(4): 26-28 (2004)

Vossen, G.; Lytras, M.; Koudas, N., Knowledge and Data Engineering in the Semantic Web Era, IEEE Transactions on Knowledge and Data Engineering, 19 (2) 2007

Davies J., Lytras M., and Sheth A., Semantic-Web-Based Knowledge Management, IEEE Internet Computing, 11(5) 2007

Scacchi W., Lytras M., Open Source for Computer Engineering Education: Pedagogical strategies beyond tools ,IEEE Transactions on Education, 50 (4) 2007

Ambjörn Naeve, Miltiadis Lytras, Wolfgang Nejdl, Nicolas Balacheff, Joseph Hardin, Advances of Semantic Web for E-learning: Expanding learning frontiers, British Journal of Educational Technology, 37(3) 2006

Sampson D., Lytras M., Wagner G. and Diaz P., Ontologies and the Semantic Web for E-learning, Educational Technology and Society Journal, 7(4) 2004

Lytras M., Advances of Knowledge Management and Semantic Web for Social Networks, Computers in Human Behavior,

Miltiadis Lytras, Ambjörn Naeve, Constantine Makropoulos, Vipul Kashyap, Knowledge Management and Semantic Web within the Health, Pharmaceutical and Clinical Sectors: Towards patient-centric health care systems, International Journal of Technology Management

Miltiadis Lytras, John Carroll, Social and Humanistic Computing for the Knowledge Society, Computers in Human Behavior,

Miltiadis Lytras, Patricia Ordonez De Pablos, Knowledge Management Research: Systems and Applications, Human Factors and Ergonomics in Manufacturing

Miltiadis D. Lytras, Patricia Ordonez de Pablos, and Waldemar Karwowski , Semantic Web for human centric designs in Industry, Human Factors and Ergonomics in Manufacturing

5.6 Guest Editor of special issues of International Journals not listed in SCI/SSCI JCR ISI reports.

Lytras M., Sicilia M.A., Kinshuk, Sampson D. (eds), Semantic and social aspects of learning in organizations, The Learning Organization Journal, Volume 12, Issue 5, 2005

<http://www.emeraldinsight.com/Insight/viewContainer.do?containerType=Issue&containerId=22676>

Lytras M., Sicilia M.A, Davies J., Kashyap V., "Digital libraries in the knowledge era: Knowledge management and Semantic Web technologies", *Library Management*, Volume 26 Issue 4/5 , 2005

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Lytras M., Iyer L., Tsakalidis A., "Exploiting Knowledge Management for Ubiquitous E-Government in the Semantic Web Era", *Electronic Government, an International Journal (EG)*, Vol. 3 Issue (1) 2006

<http://www.inderscience.com/browse/index.php?journalID=72&year=2006&vol=3&issue=1>

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<http://www.upgrade-cepis.org/issues/2005/5/upgrade-vol-VI-5.html>

Gutiérrez de Mesa JA, Rodríguez-García D., Lytras M., "Ubiquitous Computing", *Upgrade*, Digital journal of CEPIS (Council of European Professional Informatics Societies), Vol. VI, October 2005

<http://www.upgrade-cepis.org/issues/2005/5/upgrade-vol-VI-5.html>

IJ of Knowledge and Learning, Special Issue on: "Knowledge Society: A roadmap for government consultation", <http://lists.w3.org/Archives/Public/semantic-web/2006Feb/0085.html>

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U of Knowledge and Learning, Special Issue on: "Knowledge and Learning Technologies for National Educational Systems: New Horizons for open minds", <http://www.cs.wisc.edu/dbworld/messages/2006-04/1146230916.html>

U of Knowledge and Learning, Special Issue on: "Learning and Interacting in the Web: Social Networks and Social Software in the Web 2.0", <http://www.inderscience.com/browse/callpaper.php?callID=437>

U of Knowledge and Learning, Special Issue on: "Empirical Surveys on the Adoption of ICTs in Schools: From Wishful Thinking to Constructivist Learning and Beyond", <http://www.inderscience.com/browse/callpaper.php?callID=413>

U of Teaching and Case Studies, Special Issue on: "Information Systems: The new research agenda the emerging curriculum and the new teaching paradigm", <http://www.cs.wisc.edu/dbworld/messages/2006-05/1148906830.html>

U of Teaching and Case Studies, Special Issue on: "Teaching Knowledge Management: Integration into Curriculum, Teaching Strategies and Teaching Case Studies", <http://www.inderscience.com/browse/callpaper.php?callID=432>

U of Teaching and Case Studies, Special Issue on: "Teaching Semantic Web: Integration with CS/IS curriculum and Teaching Case Studies", <http://www.inderscience.com/browse/callpaper.php?callID=428>

U of Management in Education, Special Issue on: "Exploiting Information and Communication Technologies for Effective Management of Education: Towards Interactive Managerial and Leadership Styles in Schools", <http://www.inderscience.com/browse/callpaper.php?callID=435>

International Journal of Technology Enhanced Learning (IJTEL), Technology Enhanced Learning in FP5-FP6 and FP7 Programmes of the European Union: A European Citizen/Learner Perspective – Real World Learning Services – Missing Opportunities – Great Challenges, <http://www.inderscience.com/browse/callpaper.php?callID=653>

International Journal of Technology Enhanced Learning (IJTEL), Technology Enhanced Learning for People with Disabilities: Visions, Strategies, Applications, and Policies, <http://www.inderscience.com/browse/callpaper.php?callID=654>

International Journal of Technology Enhanced Learning (IJTEL), Web 2.0 for Technology Enhanced Learning Social Dynamics and Social Engineering for Learning - a New Era for Learning Content Creation and Exploitation, <http://www.inderscience.com/browse/callpaper.php?callID=655>

International Journal of Social and Humanistic Computing, Anti-Poverty: Information Technology for Social and Human Networks Against Poverty, <http://www.inderscience.com/browse/callpaper.php?callID=631>

International Journal of Social and Humanistic Computing, Information Technology for People with Disabilities: Expanding Human Frontiers,
<http://www.inderscience.com/browse/callpaper.php?callID=632>

International Journal of Social and Humanistic Computing, "Open" Prisons: Learning/Working/Educating/ Inspiring/Involving -Inclusion for People in Prisons,
<http://www.inderscience.com/browse/callpaper.php?callID=633>

International Journal of Social and Humanistic Computing, The School of the Future: New World, New School - Knowledge Society to its Best
<http://www.inderscience.com/browse/callpaper.php?callID=634>

International Journal of Digital Culture and Electronic Tourism (IJCET), Digital Libraries: From Alexandria to YouTube and Wikipedia – Embedding Social Dynamics", <http://www.inderscience.com/browse/callpaper.php?callID=637>

International Journal of Digital Culture and Electronic Tourism (IJCET), Digital Culture and Cultural Heritage: Archives, Museums and Art – New Technologies, New Channels, New Culture",
<http://www.inderscience.com/browse/callpaper.php?callID=639>

International Journal of Digital Culture and Electronic Tourism (IJCET), National Tourism Organisations and Exploitation of Information Technologies - Tourism Portals in the Web 2.0 and Semantic Web Era,
<http://www.inderscience.com/browse/callpaper.php?callID=640>

International Journal of Electronic Banking (IJBANK), Strategic Management of E-Banking: Business Strategies and Beyond - Alternative Channels and New Core Businesses", <http://www.inderscience.com/browse/callpaper.php?callID=645>

International Journal of Electronic Banking (IJBANK), Advances in Knowledge Management for E-banking - Towards High Performance Banking Systems",
<http://www.inderscience.com/browse/callpaper.php?callID=647>

International Journal of Electronic Banking (IJBANK), Enterprise Resource Planning Systems in the Banking Industry - Reengineering of Process and Exploitation of Emerging Technologies,
<http://www.inderscience.com/browse/callpaper.php?callID=648>

Democratic Internet - Foundations, Ideas, Approaches, and New Perspectives

Free/Libre and Open Source Software as a Foundation for E-Democracy
 Participation in Democracy for All - the Society of Active Citizens, an E-Democracy Primer

5.7 Authoring/Editing of Academic/Scientific Books

http://www.amazon.com/s?ie=UTF8&page=1&rh=n%3A283155%2Cp_27%3AMiltiadis%20Lytras

1. Patricia Ordonez de Pablos, Robert D. Tennyson, Miltiadis Lytras: Assessing the Role of Mobile Technologies and Distance Learning in Higher Education. 1st edited by Patricia Ordonez de Pablos, Robert D. Tennyson, Miltiadis Lytras, 12/2014; IGI Global., ISBN: 1466673168
2. Patricia Ordóñez de Pablos, Miltiadis Lytras, José Emilio Labra Gayo: Cases on Open-Linked Data and Semantic Web Applications. Edited by Patricia Ordóñez de Pablos, Miltiadis Lytras, José Emilio Labra Gayo, 01/2013; IGI Global., ISBN: 1466628278
3. Miltiadis Lytras, Da Ruan, Robert D. Tennyson, Patricia Ordonez De Pablos, Francisco José García Peñalvo, Lazar Rusu: Information Systems, E-learning, and Knowledge Management Research. Communications in Computer and Information Science (Book 278) edited by Miltiadis Lytras, Da Ruan, Robert D. Tennyson, Patricia Ordonez De Pablos, Francisco José García Peñalvo, Lazar Rusu, 01/2013; Springer., ISBN: 978-3642358784
4. Miltiadis Lytras, Isabel Novo-Corti: Trends and Effects of Technology Advancement in the Knowledge Society. Edited by Miltiadis Lytras, Isabel Novo-Corti, 06/2012; IGI Global., ISBN: 1466617888
5. Patricia Ordonez De Pablos, Miltiadis Lytras: Knowledge Management and Drivers of Innovation in Services Industries. 1st edited by Patricia Ordonez De Pablos, Miltiadis Lytras, 04/2012; IGI Global., ISBN: 1466609486
6. Miltiadis Lytras, Patricia Ordóñez de Pablos, Ernesto Damiani: Semantic Web Personalization and Context Awareness: Management of Personal Identities and Social Networking. 1st edited by Miltiadis Lytras, Patricia Ordóñez de Pablos, Ernesto Damiani, 04/2011; IGI Global., ISBN: 1615209212
7. Miltiadis Lytras, Patricia Ordóñez de Pablos, Ernesto Damiani, Lily Diaz: Digital Culture and E-Tourism: Technologies, Applications and Management Approaches. 11/2010; IGI Global., ISBN: 978-1615208678
8. Miltiadis D. Lytras, Patricia Ordonez de Pablos, Adrian Ziderman, Alan Roulstone, Hermann Maurer, Jonathan B. Imber: Organizational, Business, and Technological Aspects of the Knowledge Society. Communications in Computer and Information Science (Book 112) edited by Miltiadis Lytras, Patricia Ordonez de Pablos, Adrian Ziderman, Alan Roulstone, Hermann Maurer, Jonathan B. Imber, 10/2010; Springer., ISBN: 978-3642163234
9. Miltiadis Lytras, Patricia Ordonez De Pablos, Adrian Ziderman, Alan Roulstone, Hermann Maurer, Jonathan B. Imber: Knowledge Management, Information Systems, E-Learning, and Sustainability Research: Third World Summit on the Knowledge Society. Springer CCIS 111 proceedings edited by Miltiadis D. Lytras (Editor), Patricia Ordonez De Pablos (Editor), Adrian Ziderman (Editor), Alan Roulstone (Editor), Hermann Maurer (Editor), Jonathan B. Imber (Editor), 10/2010; Springer., ISBN: 3642163173
10. Patricia Ordonez de Pablos, Miltiadis Lytras, Waldemar Karwowski, Rongbin W.B. Lee: Electronic Globalized Business and Sustainable Development Through IT Management: Strategies and Perspectives. 1st edited by Patricia Ordonez de Pablos, Miltiadis Lytras, Waldemar Karwowski, Rongbin W.B. Lee, 08/2010; IGI Global., ISBN: 161520623X
11. Miltiadis D. Lytras, Patricia Ordonez de Pablos, David Avison, Janice Sipior, Qun Jin, Walter Leal, Lorna Uden, Michael Thomas, Sara Cervai, David Horner: Technology Enhanced Learning: Quality of Teaching and Educational Reform. Communications in Computer and Information Science (Book 73) edited by Miltiadis D. Lytras, Patricia Ordonez de Pablos, David Avison, Janice Sipior, Qun Jin, Walter Leal, Lorna Uden, Michael Thomas, Sara Cervai, David Horner, 07/2010; Springer., ISBN: 3642131654
12. Miltiadis Lytras, Patricia Ordóñez de Pablos: The China Information Technology Handbook. http://www.amazon.com/China-Information-Technology-Handbook-ebook/dp/B008BBJDRG/ref=sr_1_3?ie=UTF8&qid=1417770911&sr=8-3&keywords=MILTADIIS+LYTRAS 03/2010; Springer US.
13. Miltiadis Lytras, Ernesto Damiani, Patricia Ordonez de Pablos: Web 2.0: The Business Model. 1st edited by Miltiadis Lytras, Ernesto Damiani, Patricia Ordonez de Pablos, 02/2010; Springer., ISBN: 1441946772

14. Amit Sheth, Miltiadis Lytras: *Progressive Concepts for Semantic Web Evolution: Applications and Developments*. Edited by Amit Sheth, Miltiadis Lytras, 02/2010; IGI-Global, Information Science Reference., ISBN: 160566992X
15. Miltiadis D. Lytras, Patricia Ordóñez de Pablos, Ernesto Damiani, David Avison, Ambjörn Naeve, David G. Horner: *Best Practices for the Knowledge Society. Knowledge, Learning, Development and Technology for All. Communications in Computer and Information Science (Book 49)* edited by Miltiadis D. Lytras, Patricia Ordóñez de Pablos, Ernesto Damiani, David Avison, Ambjörn Naeve, David G. Horner, 09/2009; Springer., ISBN: 3642047564
16. Miltiadis Lytras, Patricia Ordóñez de Pablos: *Social Web Evolution: Integrating Semantic Applications and Web 2.0 Technologies (Advances in Semantic Web and Information Systems)*. Edited by Miltiadis Lytras, Patricia Ordóñez de Pablos, 02/2009; Information Science Reference., ISBN: 1605662720
17. Miltiadis Lytras, Patricia Ordóñez de Pablos: *Emerging Topics and Technologies in Information Systems*. 1st edited by Miltiadis Lytras, Patricia Ordóñez de Pablos, 01/2009; Information Science Reference., ISBN: 1605662224
18. Lytras, M.D, Damiani, Carroll, J.M, Tennyson, R.D, Avison, Naeve, Dale, Lefrere, Tan, Sipiør, G. Vossen: *Visioning and engineering the knowledge society - A web science perspective. Proceedings of the Second World Summit on the Knowledge Society: WSKS 2009*. 01/2009; Springer.
19. Miltiadis Lytras, Robert Tennyson, Patricia Ordóñez de Pablos: *Knowledge Networks: The Social Software Perspective*. 1st edited by Miltiadis Lytras, Robert Tennyson, Patricia Ordóñez de Pablos, 11/2008; IGI Global., ISBN: 1599049767
20. Miltiadis Lytras, et al: *Emerging Technologies and Information Systems for the Knowledge Society: First World Summit on the Knowledge Society*. Edited by Miltiadis D. Lytras, John M. Carroll, Ernesto Damiani, Robert D. Tennyson, 10/2008; Springer., ISBN: 3540877800
21. Miltiadis Lytras, John M. Carroll, Ernesto Damiani, Robert D. Tennyson, David Avison, Gottfried Vossen, Patricia Ordóñez de Pablos: *The Open Knowledge Society: A Computer Science and Information Systems Manifesto*. CCIS Proceedings 09/2008; Springer., ISBN: 3540877827
22. Miltiadis Lytras, Meir Russ, Ronald Maier, Ambjörn Naeve: *Knowledge Management Strategies: A Handbook of Applied Technologies*. 1st edited by Miltiadis Lytras, Meir Russ, Ronald Maier, Ambjörn Naeve, 04/2008; IGI-Global., ISBN: 1599046032
23. Miltiadis Lytras, Dragan Gasevic, Patricia Ordóñez de Pablos, Weihong Huang: *Technology Enhanced Learning: Best Practices*. Information Science Reference edited by Miltiadis Lytras, Dragan Gasevic, Patricia Ordóñez de Pablos, Weihong Huang, 04/2008; IGI-Global., ISBN: 1599046008
24. Jorge Cardoso, Miltiadis Lytras: *Semantic Web Engineering in the Knowledge Society*. 01/2008: pages 424; Information Science Reference, IGI Global.
25. Jorge Cardoso, Martin Hepp, Miltiadis Lytras: *The Semantic Web: Real-World Applications from Industry. Semantic Web and Beyond (Book 6)* edited by Jorge Cardoso, Martin Hepp, Miltiadis Lytras, 10/2007; Springer., ISBN: 978-0387485300
26. Miltiadis Lytras, Ambjörn Naeve: *Ubiquitous and Pervasive Knowledge and Learning Management: Semantics, Social Networking and New Media to Their Full Potential*. 1st edited by Miltiadis Lytras, Ambjörn Naeve, 02/2007; IGI Global., ISBN: 1599044838
27. Amit Sheth, Miltiadis Lytras: *Semantic Web-Based Information Systems: State-of-the-Art Applications*. 1st edited by Amit Sheth, Miltiadis Lytras, 11/2006; IGI-Global., ISBN: 1599044269
28. Miltiadis Lytras, Ambjörn Naeve: *Intelligent Learning Infrastructures for Knowledge Intensive Organizations: A Semantic Web Perspective*. <http://www.igi-pub.com/books/details.asp?id=4925> edited by Miltiadis D. Lytras, Ambjörn Naeve, 01/2005; IGI-Global., ISBN: 1-59140-503-3

6. Conferences Organizing

6.1 World Summit on the KNOWLEDGE

SOCIETY <http://www.open-knowledge->

society.org/summit.htm

International Conference on Metadata and Semantics Research Series
– MTSR Conference Series

6.4 International Workshop Series on Ontology, Conceptualizations and
Epistemology for Software and Systems Engineering (ONTOSE)

6.5 Co-Chairing –Member of PC

1. ECIS Track on Semantic Web and Information Systems (Founder of series and co-chair):

ECIS 2005/2006/2007, European Conference on Information Systems,
http://www.ecis2006.se/02_conferencetracks/semwebis.html

2. First International Workshop on Ontologizing Industrial Standards - OIS 2006 (Co-Chair) - in conjunction with the 25th International Conference on Conceptual Modeling (ER2006), Tucson, Arizona, USA,

Lectures notes in Computer Science proceedings, November 6-9, 2006, <http://events.deri.at/ois2006/>

3. FORMAL ONTOLOGIES MEET INDUSTRY (PC member)

FOMI 2005 / FOMI 2006/ FOMI 2007 - Workshops 2005-2006-2007 <http://www.loa-cnr.it/Files/FOMI2005/frame/pc.htm> <http://www.loa-cnr.it/fomi/>

4. The Second International Conference on Open Source Systems- Workshop on Preserving Quality in an Open Environment - OSS 2006,

8 - 10 June 2006, Grand Hotel,
Como, Italy
<http://openculture.org/como-2006>

5. Semantic Web and Information Systems/Ebusiness Track

AMCIS 2005/2006/2007 Americas Conference on Information Systems, Connecting the Americas, Acapulco, México August 4-6, 2006,;
<http://www.terry.uga.edu/%7Erwatson/t-racks.xml> HT'06 Seventeenth ACM Conference on Hypertext and Hypermedia - APS'06 Joint

International Workshop on Adaptivity, Personalization & the Semantic Web

6. Industrial Applications of Semantic Web: 1st International IFIP/WG12.5 Working Conference on Industrial Applications of Semantic Web (IASW05)

Jyväskylä, Finland, 2005, <http://www.jyu.fi/erillis/agora/en/news/iasw-2005>

8. **International Conference on Semantics, Knowledge and Grid- SKG Series, IEEE computer society proceedings (PC member 2006,2007)**

<http://www.culturegrid.net/SKG2006/>

<http://www.culturegrid.net/SKG2007/>

9. **Fifth International Workshop on Ontologies and Semantic Web for E-Learning (SWEL) (PC member)**

<http://compsci.wssu.edu/iis/swel/SWEL07/swel07-aiel07-organization.html>

10. **TEL-CoPs'07: 2nd International Workshop on Building Technology Enhanced Learning solutions for Communities of Practice held in conjunction with the 2nd European Conference on Technology Enhanced Learning**

Crete, Greece, September 17, 2007

<http://palette.cti.gr/workshops/telcops07.htm>

htm

11. **Management International Conference,**

2006, <http://www.mic.fm-kp.si/2006/?id=3>

7. Recommendation Letters

Professor Amit Sheth

Computer Science & Engineering, Wright State

University Director: Kno.e.sis Center, USA

Email: Amit.sheth@wright.edu

Editor in Chief: International Journal on Semantic Web and Information

Systems Editor: Semantic Web and Beyond Springer Book Series

URL: <http://knoesis.org/amit/>

Professor Ernesto Damiani

Professor at the Dept. of Computer Technology, University of

Milan, Italy Head of the University of Milan's Ph.D. School in

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/

Professor Gottfried Vossen

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Chair and founding board member of **AIS SIG on Ontology-driven**

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Director: Information Engineering Research Unit

Editor in Chief, International Journal of Metadata, Semantics and

Ontologies Email: msicilia@uah.es

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8. Citations – H-index Number

More than 2500

citations h-INDEX: 28

Curriculum Vitae**Prof. Dr. Udo Bleimann**

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Education:

1975 Diploma in mathematics (MSc), University of Frankfurt, Germany
 1981 Doctorate in economics (Dr. rer. pol.), University of Frankfurt, Germany

Experience:

1969 - 1975 Freelance Consultant in Frankfurt and Munich in the areas IT-advice, programming, mathematical methods in industry, especially for banks

1975 - 1980 Assistant lecturer, University of Frankfurt, Faculty of Economics

1981 - 1984 Metallgesellschaft AG, Frankfurt: board assistant for IT, planning; information department

Since 1985 Professor for telecommunication and business computing at Darmstadt University of Applied Sciences and Principal consultant for banks and telecommunication companies.

1986 - 2011 President of scientific society: Zentrum für Angewandte Informatik in Darmstadt e.V. (z.a.i.). Since 2011 vice president.

Co-organisation and chair of many conferences and workshops in Human Computer Interaction and Telecommunications M&C 2001-2013, INC 1998-2012, SEIN 2007-2013, CERC 2010-2013

Supervisor of more than 550 Diploma, Bachelor and Master dissertations; out of these at least 300 industry projects. Supervisor of 20 Phd-projects together with CIT Cork and University of Plymouth and five Masters by research.

Project management of research projects, e.g. "A Human Factors Based User Interface Design – IDA", Security and Distant Learning (ICInet and SDLearn), "Virtual University – Mobile Agents and Security", "Atlantis University – next steps beyond e-Learning", "Knowledge Broker Network", "eAgora – Modelling Knowledge Spaces", see also:
<http://www.aida.h-da.de/myresearch/index.html>

- 1985 - 2005 Member of the Computer Science department's parliament.
- 1989 - 1992 Head of Computer Science department and chairman of the university parliament.
- 2000 - 2010 Member of the Senat (parliament) of the Darmstadt University of Applied Sciences.
- 2001 - 2008 Member of the Strategic Planning Committee of Darmstadt University of Applied Sciences – 2004-2008 chairman of this committee
- 2002 - 2011 Managing Director Institute of Applied Informatics Darmstadt ([aiDa](#)). This institute is organising R&D projects mainly together with industry partners in a wide area of topics, e.g. Web Technology, E-Learning, Distributed Systems, System Management, Mobility, Knowledge Management.
- 2003 Founder of "Fachgruppe for Knowledge Media Design" ([www.fg-kmd.de](#)) within GI (Gesellschaft für Informatik e.V.) for interdisciplinary projects (Designers, Psychologists and IT Experts)
- Since 2004 Member of Editorial Advisory Board "Campus-Wide Information Systems", Emerald Group, UK ([www.emeraldinsight.com/cwis.htm](#)).
- 2004 - 2010 Director of Darmstadt node of CSCAN research cooperation with the University of Plymouth (<http://www.cscan.org/default.asp?page=cscan-network>)
- 2004 - 2010 PhD Coordinator of Department of Computer Science, Hochschule Darmstadt (<http://www.fbi.h-da.de/studium/phd.html>)
- 2006 - 2010 Managing Director of igdv – Center for Advanced Learning, Media and Simulation ([www.igdv.h-da.de](#))
- 2008 - 2010 PhD Coordinator of Hochschule Darmstadt (Graduate School) for all departments.
- Since 2010 Research Fellow, Cork Institute of Technology, Ireland
- Since 2010 Visiting Professor University of Plymouth (Faculty of Science and Technology, School of Computing and Mathematics).
- Since 2011 Visiting Professor Glyndŵr University, Wrexham (Institute for Arts, Science and Technology).
- Since 2011 Chairman Advisory Board, Institute of Applied Informatics Darmstadt ([aiDa](#)).

Publications:

Author, editor, and co-author of many publications in books, journals, conference proceedings etc.

A selected list of publications is online available here:

<http://www.fbi.h-da.de/organisation/personen/bleimann-udo/veroeffentlichungen.html>

Appendix VII – Expert Interviews Summaries

Dr. Lucie Rohlíková, Ph.D.

Senior researcher and lecturer at the University of West Bohemia in Pilsen (Czech Republic). Over the years acting at various positions including vice-dean and director of the distance education center.

Profile

Dr. Rohlíková holds a Ph.D. in pedagogy focused in Distance Learning and comes from a pedagogical educational background. She has published several eLearning related papers in peer reviewed journals and has authored and edited eBooks and electronic support materials. Finally, due to her position as the director of distance education center she has wide experience of TEL implementations.

Discussion

Concerns/Recommendations

Although receiving notifications through other apps besides the institutional eLearning platform is useful, the option to choose those apps including email should be provided to the user. It was explained that mTEL does offer this option, since at the first use of the application user decides which existing apps will be connected with mTEL. What could be useful though, would be an option button next to the already connected apps providing the user with the option to mute notifications from this up at any time, without dismissing it and signing out. That would offer the choice to the user to fast on/off notifications without needing to reconfigure them on the future.

Although being able to interact directly through a connected to mTEL notification, and in turn this may decrease the expertise required to a novice user (for example invoking Facebook to reply to a Moodle forum notification without entering Moodle), it was observed that in some cases like assignments, the intermediary environment is not appropriate for the learning activity. Discussion on examples of such learning activities, turned out revealing that most of such activities (if not all, like some types of assignments or a virtual class, etc.) could not be supported by the current technologies, since the host environment, (e.g. Facebook), is not designed for this purpose. In a next version of mTEL, a problem workaround

would be for mTEL to have a content scan mechanism and based on provided keywords, tags or metadata to invoke the appropriate application and not the one that pushed the notification where applicable. It should also be taken into consideration that some activities such as virtual classrooms are not supported by the mobile versions of popular eLearning tools since mobile devices are not appropriate for them either technically or due to the limitations caused by their screen size. mTEL's ability to transmit the source in connected smart devices may solve the size part of the problem but there is no feasible solution for all cases.

Dr. Rohlíková stressed that invoking the already installed by the device Voice Command system may be a challenge due to the different architectures implemented by the different vendors such as Apple and Google. Moreover, in the case of Google Android devices, there are mobile vendors that have decided to implement their own architecture for a Voice Command System (e.g. Samsung Androids equipped with the extra Samsung Voice Command system). The observation is correct and directly addresses the economic feasibility of the project. Possibly, completely different versions of mTEL need to be produced just because of that particular challenge. A possible design strategy, if the development cost for different versions is considered too would be a phased introduction (Baltzan, 2015) of the Voice Command feature per platform. For example, a full version of mTEL that includes the Voice Command System may be initially released for Androids, which cover the largest part of the users, (Android market share is first with 82.8% coverage second by iOS with 13.9%) (*Smartphone OS Market Share 2015, 2014, 2013, and 2012*, 2015) and later on for the IOs and remaining platforms. This achieves stretching the development costs over time which is always positive in cases of shortage of immediate budget.

A final recommendation made by Dr. Rohlíková was to add some extra functionality with respect not only to originating apps but also to specific people. The idea here refers to something like Favorite people being stressed with a flag, to distinct them from others. Such, minor improvements may be added to a next version of mTEL.

Positive Observations – Strengths

The idea of mTEL promoting eLearning notifications through social media and other popular apps like messengers is found by Dr. Rohlíková as useful and interesting. She agreed that mTEL will increase the up datedness of the learning community which may lead to higher engagement.

She also admitted, that mTEL will reduce or eliminate the problem of lost notifications and through the connected mobile applications will succeed in delivering them on time. This also leads to the increase of engagement of the learning community.

The ability of mTEL to directly invoke the application that generated the notification, will assist in reducing the time required to respond to notifications. This was characterized by Dr. Rohlíková as a “perfect” feature.

Moreover, the ability of mTEL to transmit content at the most appropriate format based on the communication quality but also based on availability was also found very useful.

mTEL utilizes a complementary server side of the application that is responsible to push notifications to mTEL when available. As a result, mTEL’s bandwidth and battery consumption is not burdened by checking notifications since notifications are pushed by the server side app when available. Dr. Rohlíková positively commented on this feature as well.

Dr. Rohlíková also considered the fact that mTEL being a light application and the ability to invoke connected applications to respond to notifications they originated, is another positive advantage.

In addition to the low consumption benefit offered by the fact that already installed applications are used to respond to activities, a major part of the upgrading cost is transferred to those applications. When an upgrade is available, new improvements will be shared through mTEL. This will drastically reduce the mTEL maintenance cost and was considered as another advantage of the Mobile TEL.

The mTEL user, by using the application through voice commands, would be able to interact with eLearning activities in parallel. Dr. Rohlíková believes that this feature of mTEL will help its users to reduce some of the time they spend with

eLearning activities. Additionally, she stresses that the voice command system will be helpful for people having sight challenges. In addition, it was noted that people with such challenges are already familiar with the use of voice commands already available by other mobile applications. This is something that adds to the adoptability of the mTEL application of this group of people as well.

Dr. Rohlíková's overall evaluation comment was that mTEL is a unique and interesting idea especially in the way it handles notifications.

Dr. Margarida Rocha Lucas, Ph.D.

Portugal

Postdoctoral Research Fellow at the University of Aveiro

Profile

Dr. Lucas holds a Ph.D. in Multimedia in Education from the University of Aveiro. She has served as a Postdoctoral Research Fellow in a number of Technology Enhanced Learning (TEL) projects and some education related projects. She is currently participating in two postdoctoral research projects: (1) Mobile Learning, Augmented Reality and Geocaching in Science Education and (2) "EduLabs - evaluating their impact on students' digital competence: a study in Portuguese middle schools" both related to eLearning and mLearning.

on students' digital competence: a study in Portuguese middle schools". She has co-authored three books, one of which in the TEL field, while she has contributed published book chapters in several TEL related books. Additionally, she has published six articles with scientific references in the area of TEL and related areas and seven in conference proceedings. She has been several times as member of committees, boards and also chairperson in national and international conferences, symposia, and editorial review boards in TEL and related areas.

Discussion

Concerns/Recommendations

Dr. Lucas expressed the concern that an application like Mobile TEL may create an information overload with all these generated notifications due to the increase of interactivity with the connected cooperating apps, mainly used by the eLearning platform. The main argument here is that if information overload occurs

because of mTEL, this would mean that mTEL has actually succeeded in increasing engagement with the eLearning platform, thus its main objective was achieved. Mobile applications like Facebook, have the side effect of information overload, because many actively interact with the application indicating that the application has successfully achieved to engage them in the service offered. So, information overload would be the strongest evidence of mTEL's success. Nevertheless, information overload will be a challenge that may affect the sustainability of the success of the application. For that reason, several options have already been included in this prototype design and some more may be added in future releases, as indicated by survey participants and expert recommendations. First of all, the user is given the choice on which applications, already in use, to connect to mTEL, thus limiting the traffic of notifications to fewer sources. So, if an mTEL user mostly uses Facebook, he does not have a reason to connect mTEL with every other notification generating app, installed in his device but not actively used. This will limit notifications only to Facebook. Furthermore, the user is already provided with filtering tools so that they can see a shorter list of notifications, when a plethora of such messages populates the notification list of mTEL. Following the recommendation of the previous expert evaluator (Dr. Rohlíková), this list may also be narrowed down by implementing a Favorite Contacts filter that would narrow the list of notifications to those coming from particular pre-specified people. Finally, an additional option could be, to add some software that will be responsible to compare notifications and locate those that although having the same content, were generated by different connected applications. Once such notifications are found, they might be grouped as one notification, narrowing down the total number of the notifications received. By selecting such a notification, it would expand, showing a list of the originally received applications so users may choose the one they prefer to interact with, based on the application that originated it. Considering these observations, Dr. Lucas agreed that information overload is a positive situation indicating success of the apps objectives, while solutions already exist and will be further enhanced to effectively limit or even eliminate the problem.

Positive Observations – Strengths

Dr. Lucas believes that Mobile TEL contributes to eLearning by adding value to existing technologies, especially in the case of students, taking advantage of the fact that most of them have a smartphone and Internet is widely available.

She found that mTEL's valuable contribution to eLearning engagement is achieved by keeping students updated in a way that is similar to how they use notification generating apps in their personal and social life. Based on Dr. Lucas's own example, members of the learning community through the use of mTEL, will receive notifications through Facebook, to participate in an eLearning activity similarly to how they receive a notification from the same app to respond to a party invitation. So, since such features are already successfully used in our social life, for the same reasons they will be successful in keeping us updated with respect to our eLearning responsibilities. She found the notification integration to be a "great idea". In fact, Dr. Lucas expressed strong interest not only on the prototype but also having a chance to be among the first users of an actual production version of mTEL, when it will be made available.

She also agrees that mTEL's UI is easy enough to use and very similar to existing popular applications of the market. Because of its friendly interface, the existing level of user expertise (mainly derived from the use of other mobile apps) would be more than enough for mTEL and no training will be needed.

She certainly believes that mTEL will achieve reducing the time it takes for members of the learning community to be updated on content changes and activities taking place at the institutional eLearning platform.

She agrees that the Voice Command system will reduce the time requiring to respond to notifications and therefore eLearning activities by enabling mTEL users to do so in parallel with other tasks.

She also agrees that the Voice Command system will obviously assist visually challenged people to interact and therefore engage more with eLearning activities adding to the contribution offered by mTEL in eLearning.

Dr. Lucas was also very positive with mTEL being a light, low energy consumption application not only because of saving battery but also for not influencing the performance of other applications already existing in the user's device thus

eliminating a reason for rejecting the application. This is quite important for the sustainability of the success of mTEL.

Not only the fact that the server-side application limits mTEL's bandwidth use to a minimum but also off-loads mTEL by transferring this task to an internet application server, was positively commented by Dr. Lucas.

mTEL uses services offered by the notification system of the originating application. For example, in responding to a notification in mTEL that was generated through Facebook, mTEL will invoke Facebook and hence Facebook editor to carry on with the task. Consequently, no editor software needs to be embedded in mTEL which results not only to a lighter application, but also an application with no upgrade considerations (e.g. the editor). This drastically reduces upgrading costs by transferring them to the cooperating applications, like Facebook. In our example, the editor will be upgraded by Facebook. Dr. Lucas agreed that this is also a very positive feature of mTEL.

According to Dr. Lucas, although it depends on the behavior of the user, mTEL's success in user's up datedness through the notification integration, will certainly contribute to engagement increase of both students and instructors in respect to the eLearning platform used by the institution, including constructive eLearning activities.

She also commented positively on mTEL's ability to transfer the most appropriate version available of learning content, to other more suitable devices in close proximity like a smart TV.

Dr. Lucas was asked to provide with an overall evaluation of mTEL on a scale of 1 to 5 with 1 being bad and 5 being excellent. Dr. Lucas evaluated Mobile TEL with a 4.5 on the rationale that she would reserve 5 for a hands-on experience of the application.

Closing Dr. Lucas expressed her interest on being kept updated with the evolution of this research and more importantly if an actual live version of mTEL is released. This was the most rewarding comment of this interview.

Professor Miltiadis D. Lytras, Ph.D.

Greece

Assistant Professor at Deree - The American College of Greece

Profile

According to his 22-page CV, Dr. Miltiadis D. Lytras is a Research Professor with research interest on semantic web, knowledge management and e-learning. He has more than 150 publications in these and related areas.

He has co-edited 45 special issues in international journals (e.g. IEEE Transaction on Knowledge and Data Engineering, IEEE Internet Computing, IEEE Transactions on Education, Computers in Human Behavior, Interactive Learning Environments, Journal of Knowledge Management, Journal of Computer Assisted Learning).

He has authored/[co-]edited 50 books from international publishers. He has served as the (Co) Editor in Chief of 12 international journals while he is the associate editor or editorial board member on seven more.

Professor Lytras is considered a world class expert not only in the field of eLearning but also in directly related fields such as knowledge research, social web, semantic web and learning management.

Discussion

Concerns/Recommendations

Furthermore, Professor Lytras observed that mTEL may serve as a “very good basis for running experiments and collecting eLearning user’s data” something that was not included among the objectives of the application. Based on this recommendation made by Professor Lytras, with some minor additions, mTEL software can transmit on-line usage data to the application server. This data can be used for research purposes thus providing an additional advantage to researchers in the learning community.

Additionally, Professor Lytras found that the scenarios used in the presentation of the application were very interesting with respect to the capabilities of mTEL. Based on the usage data collected by a next feature updated version, he believes that mTEL may be possibly enhanced to a version that uses such data to guide individual or collaborating instructors towards a more efficient use of shared content navigation, utilizing also the already designed push technology

implemented. Something like an eLearning Document Management where content or activities created by different instructors in different modules may be accessible to the instructor community as an indicator of how to create a similar content or activity for another course. Although this may sound as a wonderful idea still it is a very ambitious one, requiring serious analysis in order to overcome many challenges. For example, the implementation of such technology highly relies on the institutional eLearning. Such options are not currently supported by the most popular LMSs since they were designed mainly as Content Management Systems (CMS) for learning and not as document management systems. In case there is a consideration to enhance the institutional eLearning platform to support such enhancements, just for the shake of mTEL, it should also be considered as a huge, quite complicated and therefore expensive project. But even so, such changes may not occur in cases where the institutional platform is a commercial one like Blackboard, since such platforms do not offer access to the source code required for such cases. So considering all, although at first glance look interesting and exciting, they do not seem to be economically and technically feasible (Whitten, Bentley and Dittman, 2001) at least for institutional installations not based on Open Source LMSs like Moodle. Nevertheless, technology in the future might be made available for such an idea to flourish. Towards this path, Blackboard has made changes in its platform architecture to permit adaptation of third party applications such as web eBook access points and turnitin (*Turnitin UK Blackboard 9.0 Integration Instructor User Manual*. 2.1.3, 2011) through the development and implementation of “Building Blocks”³⁴.

Positive Observations – Strengths

Professor Miltiadis D. Lytras observed that the Mobile TEL application “combines and brings many fresh ideas in the eLearning arena” and he really appreciated the fact that it is a user friendly application because of the adoption of technologies already popular among the target group of users. As a result, no technical expertise is required since the users are already familiar with them. In addition, he commented positively on the effort to create a prototype for Android

³⁴ Building Blocks refers to small third party applications developed to cooperate with Blackboard in providing additional functionality, for example turnitin assessments in addition to Blackboard assessments.

devices that enabled the presentation to offer an actual snapshot of the screens thus enabling the user to better understand the use of the application.

Additionally, mTEL "offers added value to the instructor" by enabling them to use the application simultaneously with other services.

Professor Lytras believes that mTEL, due to the up datedness achieved by notification systems, will increase the engagement of students with the eLearning platform used by each institution. He added that further increase in the engagement of students may be achieved by adding personalization features which may however over burden the application.

Further on, the fact that mTEL is a light, low energy and low bandwidth consuming application was found to be a very good idea.

Professor Lytras suggested that in a system like mTEL, there are many contributions in the eLearning Theory, in the Discipline of Information Technology and in the Service offered by the application. Since actual contribution to any field, largely depends on the technology being adopted by a large number of people, mTEL by being offered to a variety of fields, achieves the objective of this thesis.

Based on his beliefs, Professor Lytras suggested that mTEL's main contribution will be the increase of instructors' engagement, who, in his opinion are not so engaged to eLearning implementations. Instructors, being the leaders in their courses, may in turn and with the assistance of mTEL give the extra initiative required for students to engage and an eLearning community to be formed.

He commended that mTEL is "a very good system that depends on state of the art technologies, includes really interesting theoretical parts that its users will easily realize and adopt".

He also commented that modern students will "love" an application like this since it will keep them updated and engage them to the eLearning content or activity without for example having to login to Blackboard.

It is also great that it exposes students to 'modular' services in the sense that students will realize that they have to use a variety of services for learning that assists constructive learning methods like discovery of learning in contrast to the

current use of a single ‘monolithic’ service as the sole source of learning. So mTEL, contributes also in the sense of providing a good response to ‘monolithic’ platforms introducing new ideas in eLearning.

Closing, Professor Lytras, admitted that he was happily surprised by the presentation of this project, acknowledging that the design and development of the mTEL model and prototype is a huge effort. Such effort made him feel confident for the delivery of an excellent research not only for what is currently designed for this project but also because mTEL set new grounds for future opportunities that may contribute to the knowledge society as the application evolves. He also added that he strongly believes that with some financial support, mTEL can be developed to an application that may be commercialized. Professor Lytras in his own words commented that overall mTEL is a ‘brilliant’ idea.

Professor Udo Bleimann, Ph.D.

Germany

Chairman Advisory Board Institute of Applied Informatics Darmstadt (aiDa)

Profile

Despite his educational background, Professor Bleimann, very early in his career started serving the information technology and computer science sector as an academic in a variety of academic and top-level administrative positions. He is the author, editor, and co-author of many book publications, journals, conference proceedings, etc. During the last ten years, he has focused his research in eLearning technologies and practices, authoring and participating in an impressive list of publications. He has also participated in several activities and appointments in a variety of Computer Science areas in addition to his profound list of publications.

Discussion

Concerns/Recommendations

Professor Bleimann observed that some changes have happened in the eLearning ecosystem since the surveys were conducted in this research. So according to his most recent data, a higher number of students, over 50%, have been exposed to LMS platforms and Moodle is currently by far the most popular

choice for Higher Education institutes as it is considered more appropriate for the area than Blackboard and others. Nevertheless, this change does not seem to affect mTEL's goals as it was established during the discussion.

Professor Bleimann, also expressed his concern with respect to the possibility of overwhelming notifications asking if any consideration was made on that. First, during the discussion it was recognized that for such a thing to happen it would mean that mTEL has successfully managed to increase the engagement of learners to eLearning activities to a level that updates on interactions of users with eLearning generates a disturbing number of notifications. It was explained that mTEL already has been designed to cope with this challenge by letting users to reduce the number of collaborating applications, filter notifications and possibly mute some of the source thus eliminating redundant updates. The remaining notifications, no matter how many, would be required for the already engaged user to continue participating in the discovery of knowledge and thus, due to user's engagement would not be considered as disturbing. Additionally, it was explained that mTEL, in contrast to what other services do (e.g. Facebook), provides one notification on the status bar of the device and a notification list. This list is a summary of all notifications received by mTEL and does not list them all thus consuming the notification list of the device.

Positive Observations – Strengths

Professor Udo Bleimann, commented that Facebook and Facebook Messenger are in decline between students in Germany, while WhatsApp seems to be the most popular messaging system. The point made here is that mTEL should be able to adjust to the market changes in respect to the popularity of collaborating applications. It was clarified that mTEL provides this flexibility through the configuration environment available to the user which runs automatically at the first time the app is executed. Also, it can be accessed through the application's options menu at any time, providing the user with the choice to add, delete or even possibly mute (at a later version) already installed collaborating applications that are supported by the current version of mTEL. This flexibility of mTEL to adjust to user preferences with respect to collaborating apps was highly appreciated by Professor Bleimann.

Having an extended IT background, Professor Bleimann immediately recognized that server side push technology is making sense for this model and highly commended on the choice not only as being architecturally the correct one but also the one consuming less energy and bandwidth at the same time.

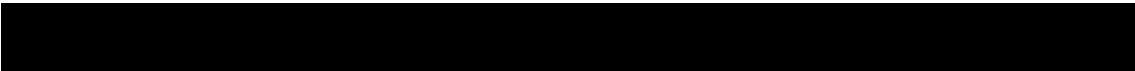
Additionally, he considered as a great advantage mTEL's ability to, invoke already existing services of the mobile device (like the native Voice Command System) and collaborating apps (like Facebook's editor to respond to Facebook originating messages). Such options offload mTEL hardware resource requirements and make it a light, low energy consumption application that does not burden the device and thus does not affect its current performance.

Furthermore, Professor Bleimann judged that the fact that mTEL is using collaborating apps functions such as Facebook editor, etc. thus transferring the cost of updates to those apps, is a real benefit that could be considered by a startup business interested to actually develop and put mTEL to production. So according to his expert opinion, there is additional actual commercial value in the Mobile TEL app since not only it does not require a big initial investment but it also has low maintenance costs.

Professor Bleimann agreed that the notification system of mTEL will increase the up datedness of both students and instructors with respect to activities occurring at the institutional eLearning platform. In fact, he was so convinced that this would result in increasing the engagement of users in eLearning activities that a disturbing number of notifications would be generated as it was already referenced above, which would be the best proof of mTEL success in achieving its objectives.

According to his opinion, he expects that the Voice Command system will assist visually challenged people to use mTEL and engage to eLearning, however, he admitted that he has limited expertise in mobile Voice Command systems.

His opinion on whether the Voice Command system will assist user to use mTEL in parallel with other activities thus reducing the time required to interact with eLearning activities, was positive but he expects that the feature will not be utilized by all users at all times depending on their location. He observed that the



feature is not suitable for noisy areas so it will not be used there but suitable for quiet areas so it may be used while driving for example.

He agreed that the user interface is easy, uses common sense and is friendly enough to be used by both students and instructors without any expertise. Also, mTEL will increase the speed of responding to eLearning activities by keeping its users updated at all times and at all places. Finally, mTEL's functionality in updating its users via multiple collaborating apps and services, is positive since eLearning up datedness does not depend anymore on the user visiting the eLearning platform to retrieve and respond to notifications.

Closing, Professor Bleimann, expressed that mTEL will easily contribute in increasing the engagement of learners with eLearning platforms. He found that idea profoundly simple and interesting expressing his surprise that nothing like this is not already on the market since, in his own words, he founds the mTEL idea so convincing and so clear that it strange that nothing like this already exists. He actually suggested that investors may be very interested in investing on the development of a working mTEL model since through it, a clear advantage will be offered in learning.

Finally, being asked to rate the application on a scale of 1 to 5, with 1 being bad and 5 being excellent. Professor Bleimann, said that he would rate it between 4 and 5 being convinced that mTEL both has commercial value and clearly contributes to learning and science.

Appendix VIII - Literature Review Summary of Methodological Research Approaches

Initially, what needs to be mentioned is that no solid approach may be thought as "ideal" in an exploration procedure. Consequently, there will always be a better or alternative way but eventually a decision needs to be taken on the selection of a feasible strategy within the variable limitations during the time and place of the implementation. The choice taken, regardless of whether it is the correct one, will be founded on the available assets and the quantity of the accessible options available (Robson, 2011). Robson argues that a research should be systematic, doubtful and moral, driving the analyst in an exploration of a higher caliber, valuable and socially mindful.

Therefore, since no single approach exists in a research plan, Gill and Johnson (2010) looked at that as a research configuration that relies upon the several included factors. These should be identified with what data is required, keeping in mind the end goal in order to find a solution for the research questions.

Moreover, Oppenheim (1992) trusts that the suitability of a study is what truly matters and that may be achieved if aims and limitations of the study are properly balanced. Also, Blaxter et al. (2006) give significance not just in recognizing a "genuine" response to a question, but additionally by building up an exploration portrayed from its reliability, honesty, trustworthiness and level of feasibility.

The positivism (customary) and the phenomenological approach are the two research points of view that can be followed by a researcher. Points of view refer to the beliefs that the analyst has in regard to the way that the investigation segments will be joined and how they will be utilized as a part of the mission to arrive at conclusions (Wisker, 2007).

Under positivism, the strategies that are mostly utilized are suitable for the natural sciences, as they include the utilization of objective techniques. This means that they depend on the speculation that they should be tried, accept the analyst's autonomy, and utilize quantitative procedures to break down the factors. Yet, for the most part, they adopt the disintegration of a problem to smaller parts that will be vertically and horizontally examined with the utilization of the cross sectional analysis (Collis and Hussey, 2009). In this research, after examining representative literature, it was found useful to test the productivity of eLearning implementations in relation to the use, participation and engagement of users. This was mainly achieved by using a quantitative approach to examine and correlate various dimensions of the researched environment.

According to Robson (2011), reality must be given quantitative means, and people cannot be dealt with as a "social unit" but as a unit that has its own perceptions. Also, it should not be treated as a logical protest but as a collaborator who will contribute decidedly to a study's decisions with their character, identity and convictions. This approach was partially used in the surveys performed for the needs of this thesis as it was mainly utilized to collect demographic characteristics of the survey participants.

What phenomenology (post-positivism point of view) states is the requirement for contemplating the distinctions existing amongst people and objects, while it requires the analyst to consider the part of the social variable subjectively

(Bryman, 2012). The way individuals think, feel, and interpret phenomena, needs to be considered under the phenomenological approach. It is understood however that the positivism factors such as the examination of hypothesis, the analyst's qualities and the related theories may impact the survey's results (Ghauri and Grønhaug, 2005). The thesis is in alignment to this since it largely aims to measure the behavioral intentions, preferences and expectations of users towards eLearning implementations.

As a consequence, the assumptions utilized by each technique (positivism and phenomenology), can be combined or negotiated under various conditions, as it is also proposed by Easterby-Smith et al. (2008). Since learning is not only depending on how it is offered (by institutions or instructors) but also by the intentions, attitudes and past experiences of students, phenomenological outcomes were also welcomed. Consequently, in several occasions throughout the thesis, quantitative questions were used to measure attitudes and behavioral intent of the user and, where necessary, qualitative methods were utilized.

Both positivism and phenomenology, consider ontological, axiological, epistemological and methodological assumptions (Creswell, 2003). Ontology is responsible for dealing with the actual conditions that impact the individual, that is whether the conditions are outside from him or are essentially produced from their brain. It implies that the real conditions acknowledged, are either observed as equitably as possible under the circumstances and are not impacted from the viewpoint of the researcher (realism) or seen subjectively which makes it considerably more complicated (nominalism). They take for granted that the contribution and views of people govern and impact the phenomena. Axiological assumptions, are either deterministic or voluntaristic (Burrell and Morgan, 1979). Deterministic assumptions consider that individuals are an extension of the environment into which they operate and they respond as part of it, while voluntaristic assume that individuals are shaping the environment in which they operate (Creswell, 2003). The epistemological presumption is identified in the knowledge a scientist will acknowledge and use in his investigation (Hussey and Hussey, 1997). Epistemology is approached in a variety of ways including not only positivism but also constructionism. Constructivism supports that the body of knowledge is the outcome of a building process while objectivism views knowledge independently from the individual's perception. (Burrell and Morgan, 1979). Finally, methodological assumptions describe the process the researcher followed throughout his research. That process is considered inductive in the sense that the evolution of the research is determined by the findings gathered in the process and deductive, in the sense, that that research is made to confirm or verify the validity of a theory. Quantitative surveys are used mostly for deductive approaches while qualitative surveys are more frequently used in inductive research (W. M. K. Trochim, 2006).

Additionally, since the novel outcome of this research is a theoretical design of a mobile application, methods like cognitive walkthroughs were investigated within the context of evaluating the application. A cognitive walkthrough is mostly used to evaluate user interfaces of developed software before they are made available to users. Nevertheless, the method seems to exhibit weaknesses such as (1) poor high-level perspective, (2) insufficiencies in the categorization of the detected usability problems and (3) complications in the presentation of the analytical results. Finally, cognitive walkthroughs are most productive when a

usable functional user interface prototype is available to be tested (Bligård and Osvalder, 2013). Due to the limitations in this research such prototype was not produced. Nevertheless, an evaluated theoretical model is frequent a requirement that influences the decision to invest on the development of a prototype. A cognitive walkthrough focuses in identifying problems that mostly novice users may have when using user-interfaces thus clearly being a Human Computer Interaction (HCI) evaluation tool (Ko, Burnett and Green, 2002). However, in this thesis, the intention was not to measure the usability of an application but rather to understand, if the functions and features incorporated in the designed model, were essentially and meaningfully addressing the user's functional requirements. This was done from a higher-level perspective rather than engaging to the details of how would this be manifested to the user if it was developed. Also, it was important to determine whether these functional requirements would make learning available to a larger pool of potential learners and assist in increasing the engagement of current eLearning users. Should those requirements be evaluated to offer a substantial contribution to learning, a cognitive walkthrough could be considered as part of a future development stage of this model. Alternatively, Use-Case diagrams and commentary is offered, along with screenshots of the model to provide a step-by-step high-level description of how the model would work.

Appendix IX - Figures not included in the main document

Student Survey

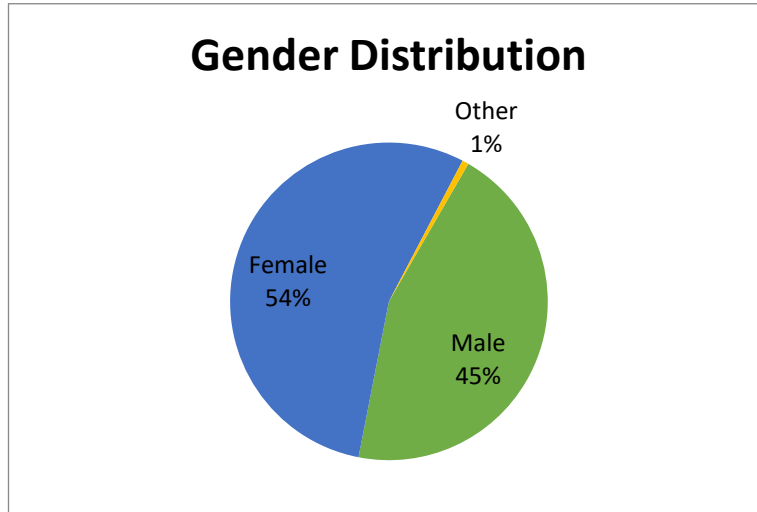


Figure 98: Gender Distribution Chart

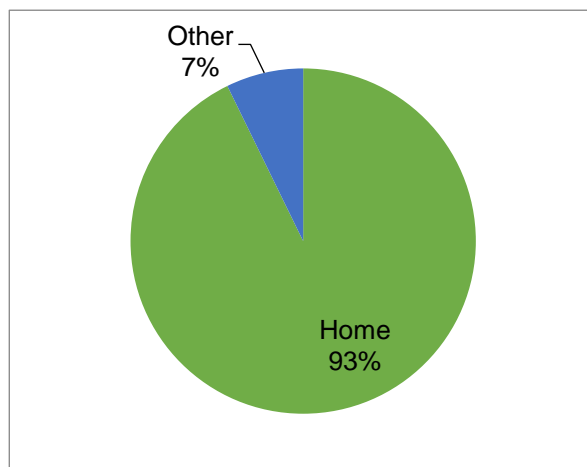


Figure 99: Internet Access from Home

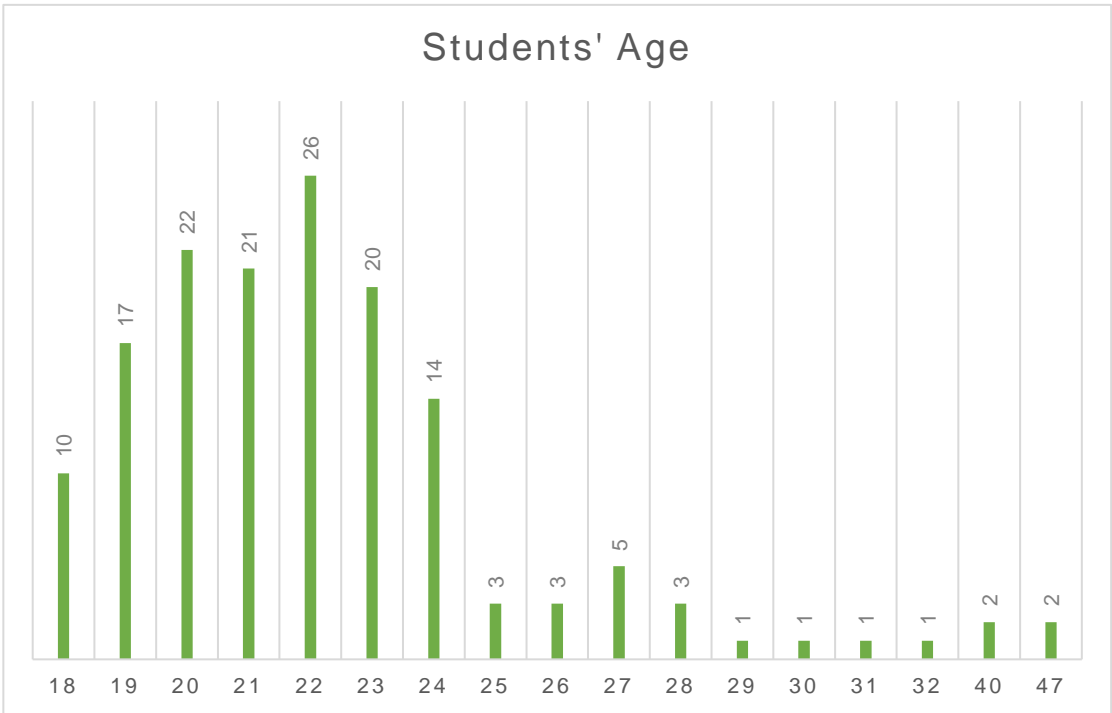


Figure 101: Age Distribution

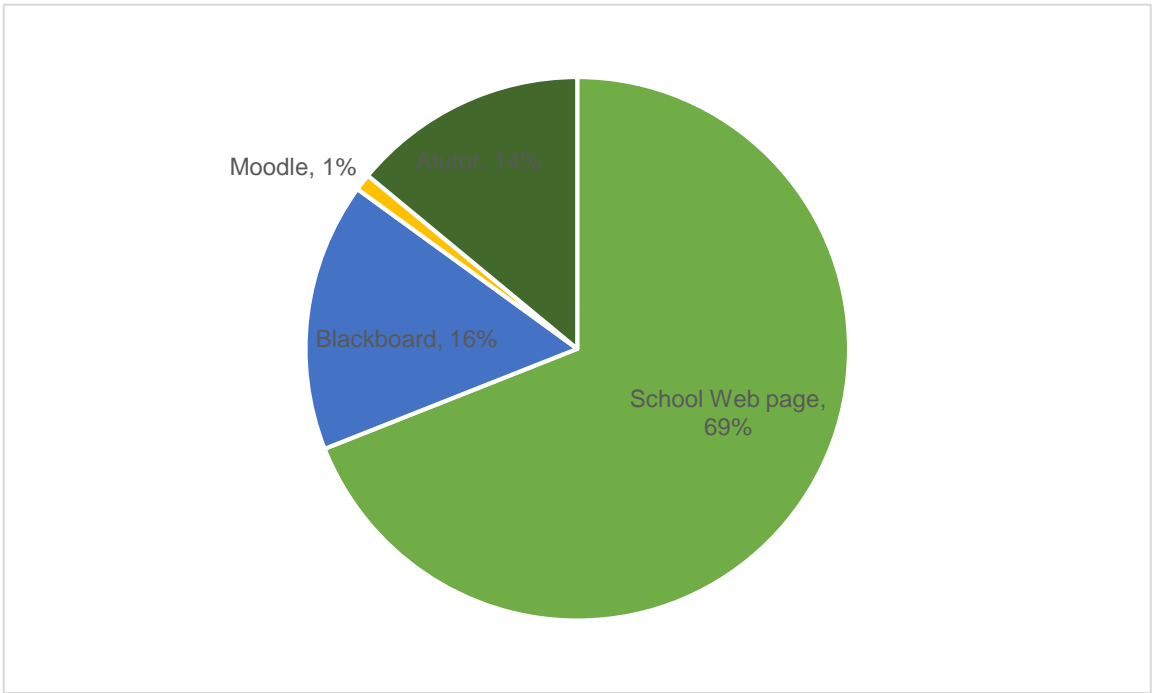


Figure 100: School eLearning Experience

Evaluation Survey (Students & Instructors)

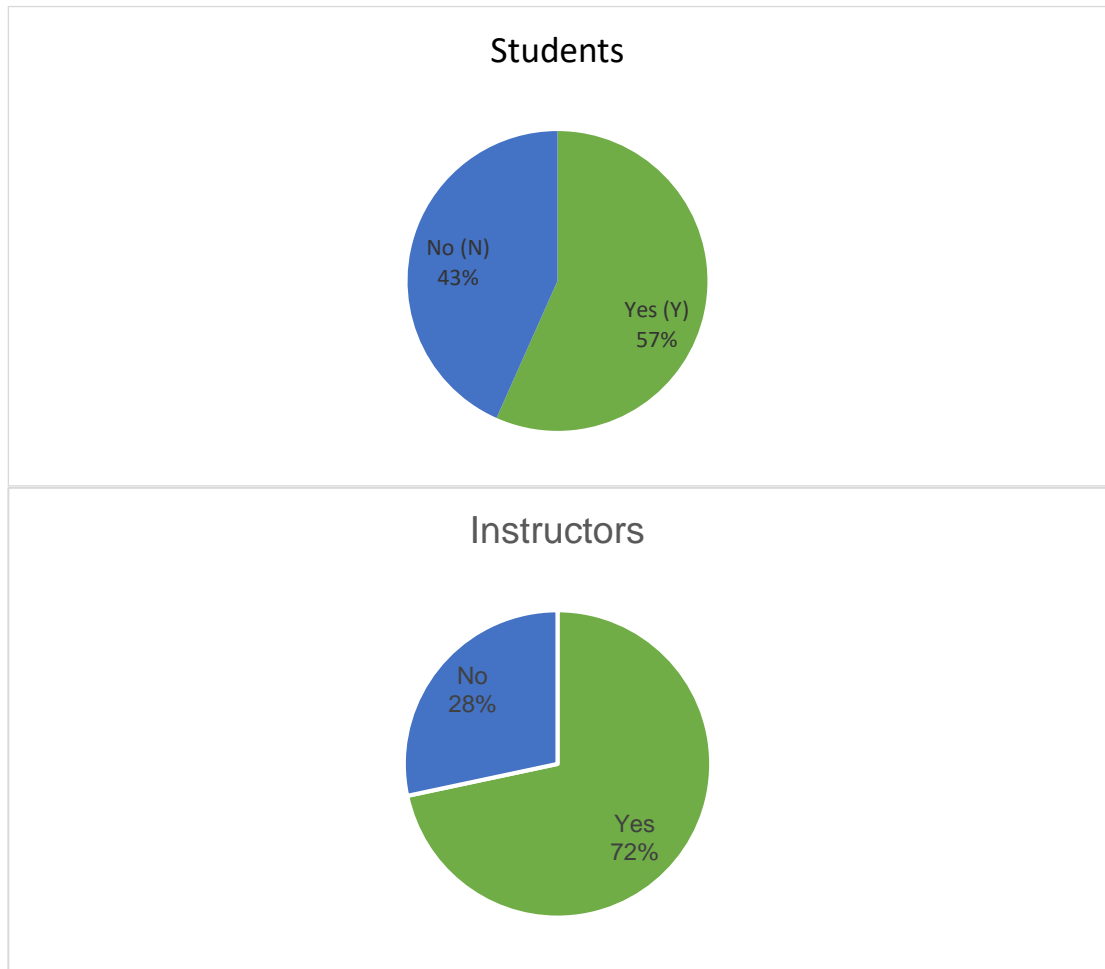


Figure 102: Connected Internet services profiles

Appendix X – Summary of reviewed Constructive Learning Theories and Models

Behaviorism

The behaviorism model suggests that learning is the response of a learners to a stimulation provided by their environment, while that response reacts with the environment causing it to change, providing a new stimulation for learning (Tomei 2010). Behaviorism is a Social Constructivism theory, which supports that our view of the world is also shaped by the conversations we have with others (Swanwick 2005). Another variation of these concepts is identified as distributed cognition (Swanwick 2005), which is based on the theories of Vygotsky (Vygotskiĭ 1978) and claims that learning does not happen apart of the social context whose influence necessary contributes to knowledge. Based on this concept, knowledge creation cannot happen individually while learners depend on knowledge of other people to act effectively. For example, if a case study becomes a group activity, then it may be expected that learning achieved will be enhanced because of the discussions and the exchange of information between the members of the group during their guided study. That type of 'situated learning' challenges the idea of formal positivistic knowledge as a more enhanced method of learning (Laurillard 2002). Nevertheless, the case study of the example may use any learning delivery method including a positivistic access to learning material that is required for constructive group meetings within the context of inductive teaching (Prince and Felder, 2006). Furthermore, according to Laurillard (2002), 'situated learning' that derives from Vygotsky's theories (1962), does not exclude the contribution of positivistic methods while it mostly relates to the psychological perspective of learning rather than to its implementation in students as it does not

provide a content-specific framework as to how the 'situation' or environment affords learning. Nevertheless, based on Laurillard (2002), students already bring their own knowledge based on their prior experiences. What needs to be considered is that this existing knowledge will affect how the new knowledge taught is acquired.

Inductive teaching

According to Prince (2006), explaining to students the value of knowledge for their future is not an effective way to motivate them. Inductive teaching and learning is a more preferred method (Prince and Felder, 2006). Instead of delivering the general principles and finally getting to applications, an alternative approach would be to start with the specifics like a case study to analyze or a real world complex problem to solve. As students start to analyze the provided case data to solve the problem, they generate by themselves the need for facts, rules procedures and guiding standards. At this point, instructors assist by presenting facts or, even better, by helping discover them by themselves. According to Prince and Felder (2006) inductive teaching is a learner centered method that puts more responsibility on students for the creation of knowledge rather than relying only on positivistic lectures. It is a method that encompasses several constructivist instructional methods such as discovery learning, inquiry learning, problem-based learning, project-based learning, etc. However, these instructional methods seem to be more appropriate for small groups of learners in courses that permit the use of cases, projects or problems (Jones et al. 2008). Additionally, Anon (2014) argues that the behaviorist approach to learning assumes a homogenous group of learners. However, such groups are difficult to

form in our days not only the diversity of students but also educational context has largely increased.

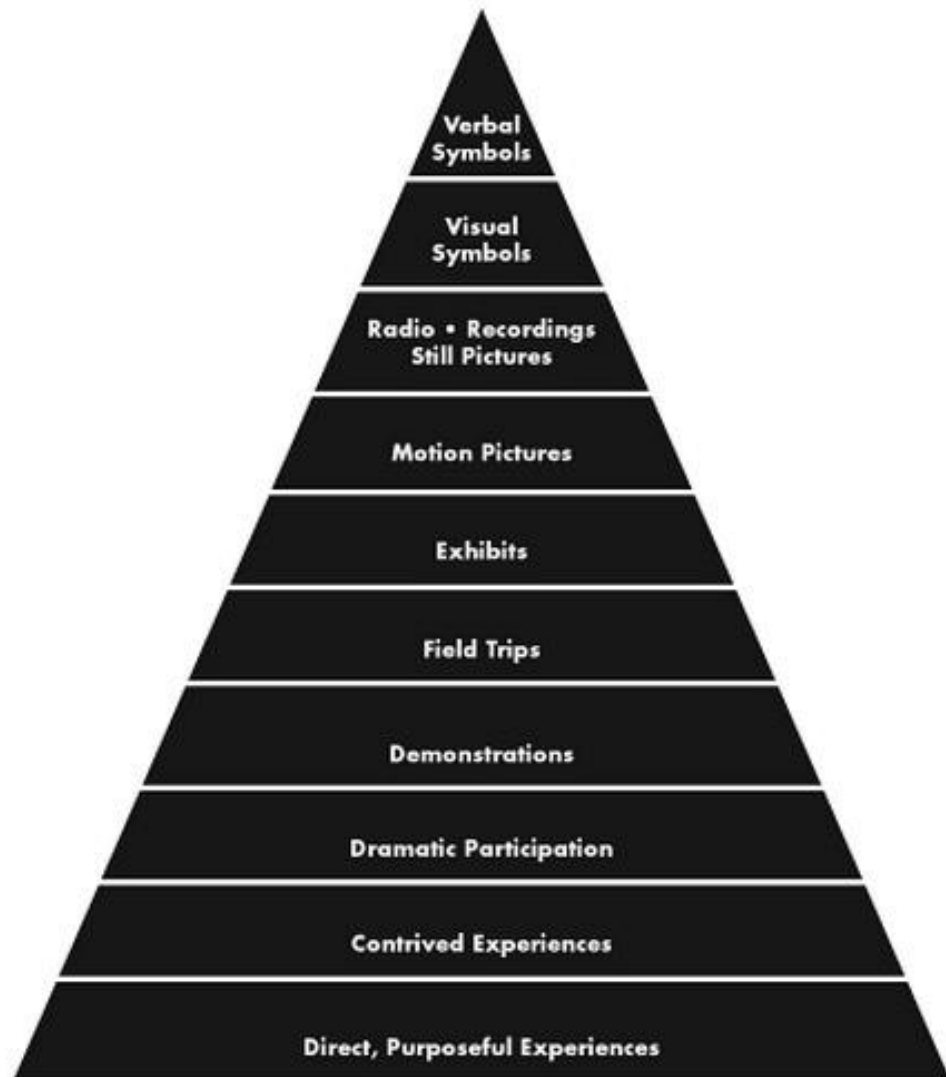
Furthermore, behaviorist approach to learning suggests that the environment, within which learners live and interact with, produces stimuli to which learners respond by learning. Taking this into consideration, academic knowledge can be achieved only by prioritizing reasoning above the impulses received by the environment. Hence, the instructor's role is to provide subjective input based on reason irrelevantly to the experiences of learners to assist them in obtaining knowledge (Hubackova 2014). Within this context, behaviorism acts as a positivistic mostly teacher-centered approach which has been criticized to serve as a transfer of knowledge method and not as construction of knowledge method (Kaya & Dönmez 2010). Consequently, it can be seen that constructivism, in most cases, is implemented upon positivism and there are many areas where these methods are blended producing hybrid implementations of knowledge delivery.

Theories of Learning supporting constructive learning implementations

Finally, reflective learning theory argues that learning may be acquired by a process of implementing the knowledge gained so far through any method of learning delivery by engaging to life-centered, problem solving activities (Castelli 2011). For example, in an eCommerce course, students' final assessment could be the delivery of an ecommerce site developed to service a business plan by means of technologies used by the actual market. That way students will test their knowledge against the requirements of the assignment, while they will have to engage into the discovery of additional knowledge that may be required.

Based on the Committee on Developments in the Science of Learning report, learners are motivated to devote time to learning by determining what they have learnt is useful and can be used towards doing something that has an impact on others (Bransford 2000). Reflective learning, especially if implemented over a group project seems to be offering an interesting and motivating way for students to realize the value of the knowledge gained in the process but also understand and have a chance to complement their weaknesses.

According to Edgar Dale's Cone of Experience (Dale 1969) as seen in Figure 103, optimum learning is achieved when the student perceives knowledge as a direct purposeful experience which is basically the objective of reflective learning. However, examining the Cone of Experience, it can be observed that an evolution of many learning methods, starting from the positivistic availability of learning material and evolving to social constructivist activities are included to finally reach the level of reflection required by a direct and purposeful experience as indicated in Figure 103 (Dale 1969). Additionally, Wager and Walter (1975) observes that Dale's cone layers are mostly focused in establishing learning attitudes mostly from a point of view suitable for research in psychology, rather than for educational experiences. Furthermore, some of the presented layers are more effective for children rather than adults. Consequently Wager and Walter suggest that Dale's theory be revised giving priority to the education perspective where attitude formation and change towards knowledge are core prerequisites for learning. Thus, although Dale's cone appears to be an important theory for psychology with respect to learning attitudes, it seems that it may not play an important role in shaping a new educational application before it is aligned within the theoretical context of education.



Source: (Dale 1969)

Figure 103: The Cone of Experience

In addition to that, STAR³⁵ Legacy (Figure 104) states that it is around a set of activities that student's inquiry is organized. It refers to a well-formed structure that includes both beneficial as well as explicit activities to learner inquiry. In that sense, participants realize their position in the cycle and the intention of its activities. Thus students understand what is involved in each one of those activities before they select and use them (Howard & Johnson 2010). Since

³⁵ Software Technology for Assessment and Reflection (STAR)

students take several courses that include such activities, we could assume that they would be benefited by a technology that will assist them organize their schedule and direct their focus towards the various activities selected or required. This assumption is to be considered for the possible requirements that will shape the final contribution of this research.



Source: (Howard & Johnson 2010)

Figure 104: STAR Legacy Inquiry Cycle

It is only reasonable to assume that higher education was dominated by the positivism model, not only because of the needs of the market during the days of the Industrial Revolution, but also maybe because it was difficult to apply in practice, the constructivism model due to lack of tools or resources. For example, large audiences in lectures are not suitable for constructive teaching (except if appropriate technology is available) but are cost effective. Based on this observation, what needs to be examined is not only how current technology could assist in enhancing positivism learning but also how to possibly enable constructivist activities within large groups without cancelling their cost effectiveness.

In 1956, Bloom (1956) along with a group of educational psychologist researchers classified the different levels of understanding that students may achieve in a

course module. The results were published in 1956, presenting the taxonomy of educational objectives as seen in Figure 105.

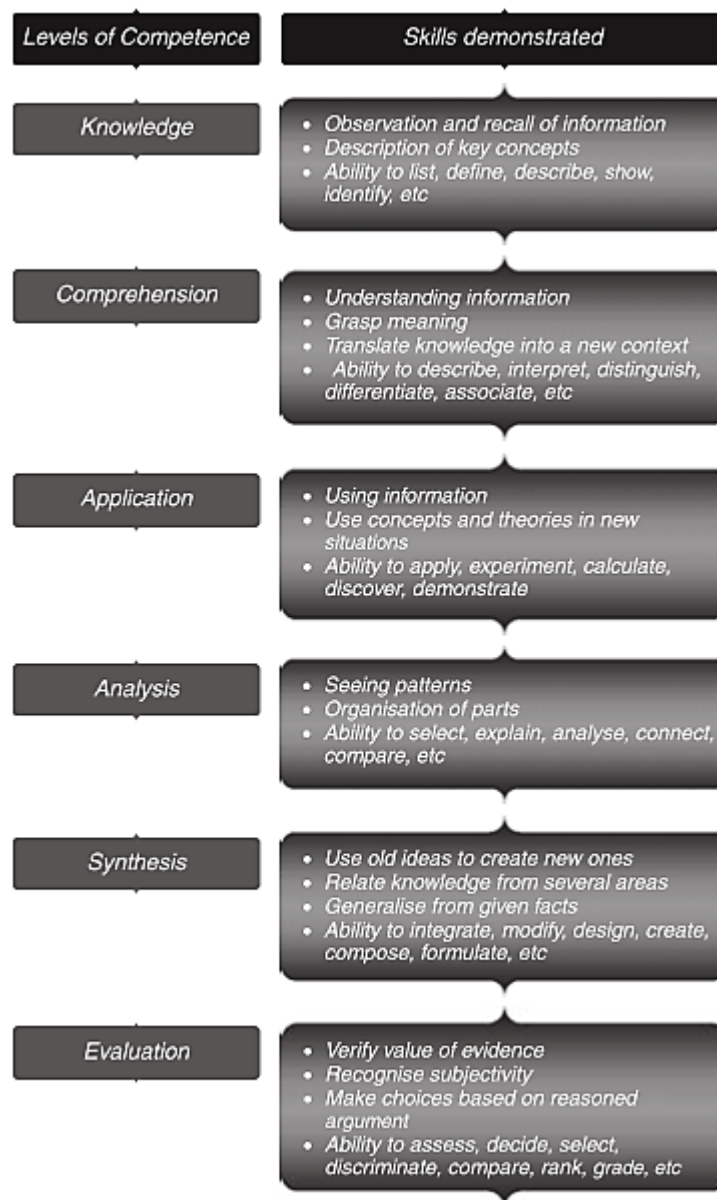


Source: (Spring 2010)

Figure 105: Bloom's Taxonomy of educational objectives

Later on, Spring (2010) provided a more detailed graphical recommendation of Bloom's Taxonomy as seen in Figure 106.

Dale (1969) tells us how we learn and Bloom (1956) explains what we learn or better yet the quality levels of learning. It is only logical to assume that reaching the higher levels of perceived knowledge, analysis, synthesis and evaluation (Spring 2010) would be easier if the learner has experienced learning as described by Dale's Cone (Dale 1969) bottom levels in Figure 103. For instance,



Source: (Spring 2010)

Figure 106: Bloom's Taxonomy (Detailed)

according to Figure 104, to achieve learning to the level that permits evaluating situations to make the appropriate required decisions, one should be able to verify the value of evidence, treat them subjectively and eventually reach to a decision that can be reasoned and assessed. This is not suggested as the only path but as an optimal one. That level of knowledge must be in alignment with having experienced several such situations in the past. In higher education, for achieving such type of knowledge, one way is to teach students through case studies. By

introducing, discussing, analyzing and finally concluding a case study in class, just applies the positivism model deliberated above. In order to move towards the constructivism model so that students achieve higher levels of perception - according to Bloom's Taxonomy (Spring 2010) - what may be needed is to possibly enrich lectures with life experiences strong enough to act as a dramatized practice. This experience should also be in alignment with the student's needs, purpose and even life situation at the time. Since every person is unique, that would be difficult even if education delivery was relying on one-on-one teaching indicating a constructivism implementation weakness with large groups against positivism which although possibly less effective is not affected by group sizes. According to Bournier (Bournier 1997), the time when teaching staff in Higher Education could simply follow the teaching methods that they experienced as students is drawing to a close. There are several powerful reasons for this such as the falling level of real resource per student, the increasing focus and publicity about teaching quality, the developments in technologies for communicating and disseminating information, etc. are some. Finally, although achieving constructivism seems difficult to implement considering the large audiences of classes handled by universities in higher education modern technological options that are researched in the following sections seem to offer ways to normalize this obstacle and assist with the implementation of constructive activities.

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